THE JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

VICTORIA,

AUSTRALIA.

PUBLISHED FOR AND ON BEHALF OF THE GOVERNMENT BY DIRECTION

OF THE

HON. W. HUTCHINSON, M.L.A.,

Minister for Agriculture.

VOLUME XI.

1913.

By Authority:

ALBERT J. MULLETT, GOVERNMENT PRINTER, MELBOURNE.

1914.

16938.

COPYRIGHT PROVISIONS AND SUBSCRIPTION RATES.

The Journal is issued monthly. The subscription, which is payable in advance and includes postage, is 3s. per annum for the Commonwealth and New Zealand, and 5s. for the United Kingdom and Foreign Countries. Single Copy Threepence.

A limited number of the issues comprising Volumes III (1905), 8 parts, exclusive of February, March, April, and May, 1905, out of print; IV. (1906), 10 parts, exclusive of Parts 7 and 9 (July and September, 1906), out of print; V. (1907), and VI. (1908), 12 parts each; VII. (1909), 10 parts, exclusive of Parts 2 and 10 (February and October, 1909), out of print; and VIII. (1910) and IX. (1911), 12 parts each, are at present in stock, and will be supplied at the foregoing rates.

Subscriptions should be forwarded to the Director for Agriculture, Melbourne

THE JOURNAL OF THE DEPARTMENT OF AGRICULTURE, VICTORIA.

VOLUME XI. Parts 1–12.

INDEX.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 1. 10th January, 1913.

BEE-KEEPING IN VICTORIA.

(Continued from page 761, Vol. X.)

By F. R. Beuhne, Bee Expert.

XI.—INTRODUCING QUEENS.

The beginner in bee-keeping often has difficulty and sometimes absolute failure in introducing a new queen to a colony of bees. Many of the queens obtained annually from queen breeders are lost in introduction, even by bee-keepers of some experience. The mood or temper of bees and their behaviour towards man and towards their own species are governed by climatic influences, variations in the secretion of nectar, and the methods of manipulation of modern bee-keeping. Incidentally it may here be pointed out that viciousness is a characteristic of some strains, and even of individual colonies of bees, and that such bees will sting when handled even under the best condition; there is, however, no additional difficulty in their inherent wickedness so far as the acceptance of a queen is concerned.

When colonies are in normal condition, the printed instructions usually sent out with queen bees will insure safe introduction; under certain conditions, which will be referred to further on, the usual method must, however, be entirely departed from. To introduce a new queen to a colony it is, first of all, necessary to find and remove the queen which is to be replaced. It is during this operation that, in most instances, the foundation for future trouble is laid. When the queen to be removed is a black or brown one, it often takes considerable time to find her. Bees from other hives are attracted, and the bees of the colony operated on are roused to a state of attacking any stranger; and, when the new queen appears amongst them a day or two later she may be killed right away or balled and worried to death.

Trouble is sometimes created by returning to the hives newly-extracted combs at a time when, unperceived by the bee-keeper, the honey flow has ceased, and a commotion is caused which is communicated to all the colonies; bees may be seen at the joints between the hive bodies or wherever the odour of honey escapes; when a hive is opened they hover round or boldly dive in between the combs. Under these conditions bees sometimes ball their own queens, and are very unlikely to accept a strange queen when deprived of their own.

The hunting up of queens should be done towards evening, when bees have ceased to fly; care should be also taken that no honey is spilt from combs so as to attract robber bees or ants next day. Bees will most readily accept a new queen after being queenless for from 24 to 48 hours. If queenless longer, queen-cells will have been started and the bees will be less friendly disposed towards a new queen.

In such a case it is better to wait a few more days, when all worker brood will be capped, and, having no means of raising a queen of their own, the bees will usually readily accept a new queen—provided *all* queen cells are destroyed before she is introduced. With a populous colony it is difficult to find all the cells, some of which may be quite small and on the face of the comb. To make sure that none are left it is best to shake the bees off the brood combs, one at a time, and carefully examine the comb all over.

If a queen is to be introduced to a colony, assumed to be queenless because no eggs are present in the combs, a test-comb containing young larvæ from another colony should first be given to see whether the colony is really queenless, in which case queen-cells will be started by the bees within 48 hours. The comb may then be removed and returned to the hive it came from, and the queen introduced. If no cells are started on the test-comb, then a virgin queen is present in the hive and must be removed, as well as the test-comb, before the new queen can be given with safety.

When a queen is received by post, remove the cover of the cage and note her condition. If satisfactory remove the cork or covering slip from the end of the cage containing the candy and, if there is a queenless colony ready for introducing, place the cage wire downwards on top of the broad-frames. The bees, by gnawing out the candy, will release the queen in from two to five days. If, on examining the cage on receipt from the Post Office, the queen is found dead, notify the sender, and as proof return the cage with bees and dead queen—you will then receive another queen—all reputable queen-breeders guarantee safe arrival.

By the method of introduction described above, the worker bees which accompanied the queen are introduced along with her. If the candy in the cage is eaten out quickly and the queen released very soon, this escort of worker bees may cause trouble. Should the colony be in a perturbed condition, they are by their odour recognised as strangers, and the animosity aroused is often transferred to the queen, while the latter, having some of her own bees round her, will be shy of strangers and frightened when getting amongst them. In introduction much depends upon the behaviour of the queen when first released amongst the crowds of her new home. If the queen is removed from the escort of bees which accompanied her in the mailing

cage (Fig. 1), and kept alone for half-an-hour, she will beg food of the first bee she comes in contact with, and this is always given her, and thus acquaintance made. For introduction by this method, what is known as Miller's introducing cage (Fig. 2) is used. (This may be obtained from the dealers in bee-keepers' supplies.) It consists of a thin wire gauze cage into which the queen only is put, the square hole at the end being plugged up with candy from the mailing cage and the cage placed horizontally between two brood-combs.

The queen will be fed by the bees through the wire gauze till released by the candy being eaten out.

Under very adverse circumstances, such as a dearth of nectar in the flora, robber bees in the apiary, or after wet extracted combs have been returned to the hives when nectar is not coming in freely, the methods of introduction usually employed often fail. If a queen *must* be introduced, it is best, before attempting it, to remove all combs containing brood, except one which is left till evening to prevent the

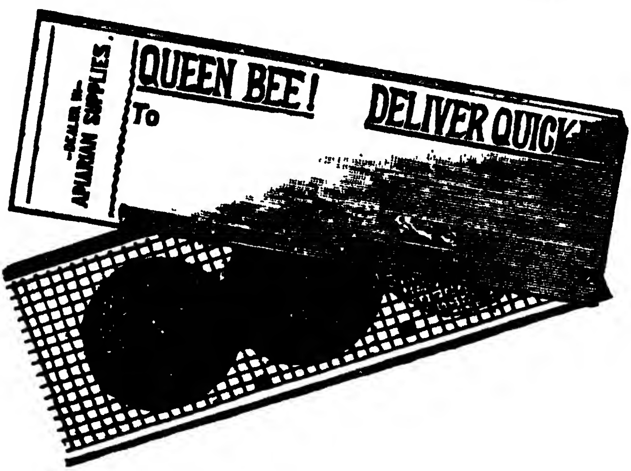


FIG. 1.—MAILING CAGE.

bees leaving and joining neighbouring hives. At dusk, shake the bees off this comb, give it to some other colony to take care of, and hang the caged queen between the broodless combs. When the brood is removed, the bees should be shaken off and the combs put on other colonies till after the new queen is safely laying, when they may be returned again without bees.

Success in introducing queens is assured largely by a minimum of interference and fussing. Most of the failures are due to two causes; either the colony has been kept open too long when hunting for the old queen, or it has been opened and examined too soon and at the wrong time after introducing the new queen. Over-anxiety of the bee-keeper for her safety often proves fatal to the queen. Under unfavorable conditions bees will sometimes ball their own queens when the hive is opened, therefore a hive which has just had a new queen given to it should not be interfered with for at least four or five days, unless an unusual commotion at the entrance indicates that

the queen is balled. If desirous of ascertaining whether the queen has been accepted, do so on the fourth or fifth day after the bees have ceased flying for the day.

If a queen is found balled, drop the ball of bees into a saucer full of water, when the bees will release the queen. If smoke is used to

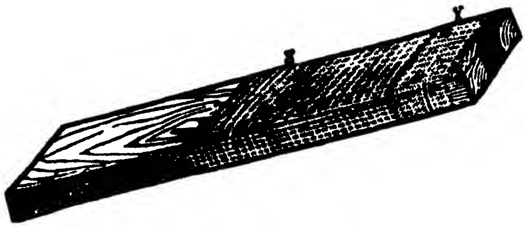


FIG. 2.—MILLER'S INTRODUCING CAGE.

scatter the ball the smoker should not be held too close, as hot smoke may cause the bees to sting the balled queen. The queen should be re-caged in the hive, allowing the bees to again liberate her by eating out the candy.

(*To be continued.*)

ON WATTLES AND WATTLE-BARK.

(*Continued from page 692, Vol. X.*)

Alfred J. Ewart, D.Sc., Ph.D., Professor of Botany and Plant Physiology in the Melbourne University.

II.—WATTLE-BARKS.

In the Bulletin of the Imperial Institute, much interesting information has been recently given in regard to wattle-barks, and as this information, which supplements that given by Baron von Mueller in the "Select Plants," and by Mr. Maiden in his article on "Wattles and Wattle-barks," may not be accessible to the ordinary reader, a summary of it is given.

Analyses are given of wattle-barks grown in different countries, for, as is well known, the cultivation of wattles for wattle-bark has not only been taken up with eagerness in South Africa, but also in other countries. For instance, Black, Green, and Golden Wattles, yielding respectively 40, 22, and 30 per cent. of tannin, are recommended for cultivation in Sicily; and at Palermo, *Acacia penninervis* (45 per cent. of tannin), *Acacia saligna* (30 per cent. of tannin), and

Acacia melanoxylon (20 per cent. of tannin), have already been grown with success. In addition, in German East Africa, *A. mollissima* and *A. decurrens* have been grown now for more than six years, and the bark was found to yield 44 per cent. and 38 per cent. of tannin respectively. The seed yielded by these wattles was found to be of first rate quality, and is being exclusively used for propagation in German East Africa.

The following data are given (*Bulletin of the Imperial Institute*, 1910, p. 246) of samples of wattle-barks from the Transvaal:—

Botanical Source.	Age of Tree	Commercial Description.	Percentage of Tannin	Character of Leather.	Estimated Value per Ton.
	Years.				£ s. d.
Acacia mollissima	14	"Sound, clean, bright bark"	42·1	Dull colour, good texture	9 0 0
,, ,,	18	Well-grown, stout bark, with old, seasoned, and burnt scale	26·7	Rather dark, good texture	6 10 0
,, ,,	8	Well grown, rather rough, hard mixed	41·5	Light colour, good texture	7 10 0
,, ,,	26	Old, burnt bark of doubtful colour	24·8	Dark-reddish and harsh	5 0 0
,, ,,	8	Small and bough bark, resembling Natal ordinary	38·6	Rather dull and somewhat harsh	7 5 0
,, ,,	10	Partly burnt and wasteful	39·2	Light, but dull in colour, and rather harsh	6 15 0 to 7 0 0
,, ,,	12	Partly burnt and wasteful	37·5	Good colour, rather soft	6 15 0 to 7 0 0
,, ,,	9	Small and bough bark, resembling Natal ordinary	36·7	Good colour and texture	7 5 0
,, ,, (?)	3	Somewhat resembles Cape Bark	27·9	Good colour, rather soft	5 10 0
,, *decurrens* ..	6	Short, thin, twig bark	24·4	Pale colour, soft, and rather spongy	5 10 0

Wattle-barks from German East Africa.

—	Percentage of Tannin.	Commercial Description.	Value per Ton.
			£ s. d.
Acacia mollissima	40·1	Badly dried	8 0 0
,, *decurrens*	32·9	Dark-red ..	7 15 0

SAMPLES FROM THE EAST AFRICA PROTECTORATE. (*Acacia mollissima.*)

Age of Tree.	Commercial Description.	Percentage of Tannin.	Nature of Leather Produced.	Estimated Value per Ton.
Years.				£ s. d.
5	Well grown, mostly of good substance, clean but rather dark inside	38·4	Good colour and texture	8 0 0
4½	Well grown, mostly of good substance, clean but rather dark inside	43·6	Good colour and stiff texture	8 0 0
3½	Stout, better colour than Nos. 1 and 2	39·6	Good colour and stiff texture	8 5 0
3½	Equal to best Natal ..	40·3	Good colour and stiff texture	8 10 0 to 8 15 0
6½	Not quite so stout or well prepared as No. 4	35·8	Good colour and stiff texture	8 10 0
10	Smooth, pale reddish-brown fracture	39·7	Light-pinkish leather of good texture and appearance	8 15 0 to 9 0 0

WATTLE-BARKS FROM THE CAPE OF GOOD HOPE.

——	Percentage of Tannin	Character of Leather.	Value per Ton.
			£ s. d.
Acacia pycnantha ..	40·09	Good	6 10 0 to 7 10 0
,, *decurrens* ..	35·36	Good	
,, ,, ..	44·15	Good	
,, *saligna*	26·38	Fawn coloured, but brittle ..	Some local value, but of no value for export
,, *horrida*	18·28	Brown, dull surface, brittle ..	
Mimosa Bark	18·00	Brown, dull surface, brittle ..	

It is evident from the above that wattle-bark can now be grown in various parts of the world, as well and as profitably as in its native home, Australia. In other words, the original monopoly has been lost; and if Australia is to regain predominance in regard to this commodity, it can only be done by the exercise of the same foresight, energy, and business qualities which have enabled other countries to become competitors in the world's market.

In three important respects, as Professor Paessler points out, wattle-barks are superior to most tanning materials. Firstly, their cost in regard to the amount of tannin available is low, and it is the more soluble tannin which is the most valuable. The less soluble portions are more difficult to extract, and produce a poorer leather. Secondly, any precipitation taking place in a tanning liquor on standing, not only hinders the tanning action on leather, but also represents the loss of a certain amount of tanning materials in the extract. In the following table Professor Paessler gives a comparison

between different tanning materials, and in the last column is included the amounts of insoluble matter deposited from tanning extracts of standard strength after standing for sixty days. As can be seen, the wattle-barks are especially satisfactory in this respect. Finally, in its power of producing a heavy leather, wattle-bark comes second only to quebracho wood.

—	Average Cost per Ton.			Average Per Cent. of Tannin Present.	Average Cost of Tannin per lb.	Insoluble Matter Deposited in 60 Days.
	£	*s.*	*d.*		d.	
Oak Bark	5	6	8	9 0	6¼	7·5
Oak Bark Extract ..	12	11	2	25·0	5½	11·5
Valonia	12	11	2	27·0	5½	29·0
Quebracho	6	1	7	19·0	3½	3·4
Divi-Divi	12	3	10	28·0	3½	29·0
Wattle Bark	10	3	2	33 0	3¼	0·0
Myrobalans .. .	7	12	5	30·0	2¾	24·0
Mangrove Bark	7	12	5	38·0	2	0·0
Gambier		..		..	..	0·0
Galls		..		..	..	16·0

IMPORTS AND EXPORTS OF TANNING BARK.

Some attention has recently been drawn to the fact that tanning bark derived from acacias native to Australia, but now cultivated in other countries, is being imported into Australia to make good the deficiency in the native product. In order to be able to give exact information in regard to this matter, Mr. G. H. Knibbs, the Commonwealth Statistician, has very kindly forwarded me information in regard to the exports and imports of tanning barks for 1911.

IMPORTS—BARK (TANNING) 1911.

Country of Origin.	Cwt.	£
iji	315	174
ther South Sea Islands	154	44
apua	93	24
outh Africa	71,685	30,898
aly	200	113
Total	72,447	31,253
Importing States.		
lew South Wales	54,898	24,031
'ictoria	10,325	4,349
jueensland	59	29
outh Australia	6,075	2,361
Vestern Australia	1,090	483
Total	72,447	31,253

EXPORTS—BARK (TANNING) 1911.

Country of Origin.	Cwt	£
New South Wales	8,933	3,883
Victoria	33,370	14,599
South Australia	11,021	5,089
Western Australia	175,590	70,947
Tasmania	24,637	10,118
Northern Territory	5	10
Total	253,556	104,646

Mr. Knibbs adds that: "The records do not disclose any further information as to the particular kind of bark, but I include the particulars of the country of origin, which will probably furnish some indication. During 1911 the imported bark was almost entirely from South Africa, and would probably be wattle-bark."

Included under the imports of tanning materials are such products as myrobalans, valonia, &c., which are not really competitors of wattle-bark, but are used for special purposes for which wattle-bark is not suitable. Since these materials cannot be grown locally, at least not in Victoria, to compete with the native product, importation in such cases is a necessity. It is, however, evident from the countries of origin that these form a relatively small proportion of the total imports of tanning materials; and it certainly seems absurd that a country like Australia should be apparently in the process of becoming dependent on the outside world for supplies of one of its own native products. The main reason probably is that too much reliance has been placed on the natural growth, and insufficient attention to planting and re-establishment. The following table shows clearly that, for some years past, a tendency has existed towards a decrease in the exports and an increase in the imports of tanning material, and this in spite of the fact that good prices are obtainable locally, and there is a steady and increasing demand for tanning materials:—

IMPORTS AND EXPORTS OF TANNING BARK DURING 1906-1911.

Particulars	1906	1907	1908	1909	1910	1911.
Quantities:—	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Imports	63	344	38,711	28,020	12,648	72,447
Exports	431,896	358,167	260,364	225,872	295,616	253,556
Excess of Exports over Imports ..	431,833	357,823	221,653	197,852	282,968	181,109

PRACTICAL HINTS AND SUGGESTIONS.

It is evident from the foregoing that there is a deficiency in the local production of wattle-bark which should be made good by an increase of planting of suitable acacias. If, however, this is to be profitable, it must be done on practical and business lines; and there are certain pests, particularly the "Fire Blight," *Paropsis orphana,*

which have been responsible for the destruction of or serious damage to large plantations intended for the production of wattle-bark. This pest appears to be specially injurious to the Common Black Wattle, *Acacia decurrens*, and to do little or no damage to the Golden Wattle, *Acacia pycnantha*. It is possible that if in the large plantations mentioned the chessboard system of planting had been adopted, and the acacias planted in small squares surrounded by other trees, there

* ACACIA DECURRENS (EARLY BLACK WATTLE).

would have been greater scope for checking the spread of the pest. There are, however, risks of this kind in all natural industries, and the fact that acacias have thrived and survived so well in Victoria for ages past, and have survived their numerous foes, shows that it is merely necessary to repeat the proper conditions for their growth to attain success in wattle cultivation.

* Photo from "Flowering Plants of New South Wales."

The following facts and practical information were obtained from technical and reliable sources:—

"The best bark is grown towards the west of Victoria, and it becomes less valuable towards the east, *i.e.*, towards Gippsland. The least variation of value according to locality appears to be shown by the Golden Wattle wherever it is grown, so far as the available

ACACIA MOLLISSIMA (LATE BLACK WATTLE).

local data are concerned. Very good bark comes from the district within a 35-40 miles radius of Portland; and good bark, mainly from the green and black wattles, comes from the districts around the Grampians (Stawell, &c.).

The imports of wattle-bark from South Africa are increasing slightly, but this is because the local supply is not keeping pace with

the demand, or is even increasing. This, again, is largely due to the indiscriminate destruction of wattles, without any attention being paid to their replacement, either naturally or artificially. They cannot re-establish themselves when continually grazed or trampled down by stock. The occasional failure of plantations is either due to lack of attention and care, or sometimes to too much zeal in cultivation, thinning, or pruning, actually encouraging the attacks of pests.

For prime samples of wattle-bark delivered in Melbourne, from £7 10s. to £8 per ton can be obtained. This applies only to the bark from the best species (golden, black, and green wattles, *A. pycnantha, decurrens, mollissima*). Where sufficient naturally grown plants exist, the bark of the Silver Wattle (*Acacia dealbata*) is worth collecting, and is used for rough tanning. It is not, however, much used locally, is hardly worth exporting, and is certainly not worth planting in comparison with the better wattles. In all cases the best bark appears to come from trees growing naturally in mixed forests.

Trees are ready to strip when they have grown to good upstanding trees with a sufficient surface of the main trunk smooth and well grown. Usually trees six or seven years old are in this condition, and ready for stripping; but to some extent the age at which the tree is ready for stripping will depend upon the species of acacia and the district and conditions under which it is grown. Under favorable circumstances wattles grow with great rapidity. Thus a tree of *Acacia mollissima* grown in the Herbarium grounds attained a diameter at the base of 26 inches at a height of 1½ feet above ground, and a height of 25 feet in four years, and would have been quite ready for stripping in that time.

It is when acacias are approaching adult size that they seem to become especially prone to the attacks of "Woolly Blight," borers, "Fire Blight," &c., and they appear to be especially prone to the first named when growing in unnaturally exposed situations. In addition, beyond a certain age the bark appears to deteriorate both physically and chemically from an economic stand-point.

The best time to strip the bark is in spring and early summer, when the sap is rising. At that time, not only does the bark come off more easily, but it is in a better condition for tanning purposes. When stripped it should be dried in thin layers of strips laid on rough frames made of wood or branches, and raised about 1 foot above ground. The strips when fully dried and bound in bundles are ready for sale as the commercial article wattle tanning bark. They should on no account be bound in bundles or stacked until quite dry, since otherwise they become mildewed, dark coloured, and deteriorate considerably in value. Neglect of this simple precaution often causes much loss."

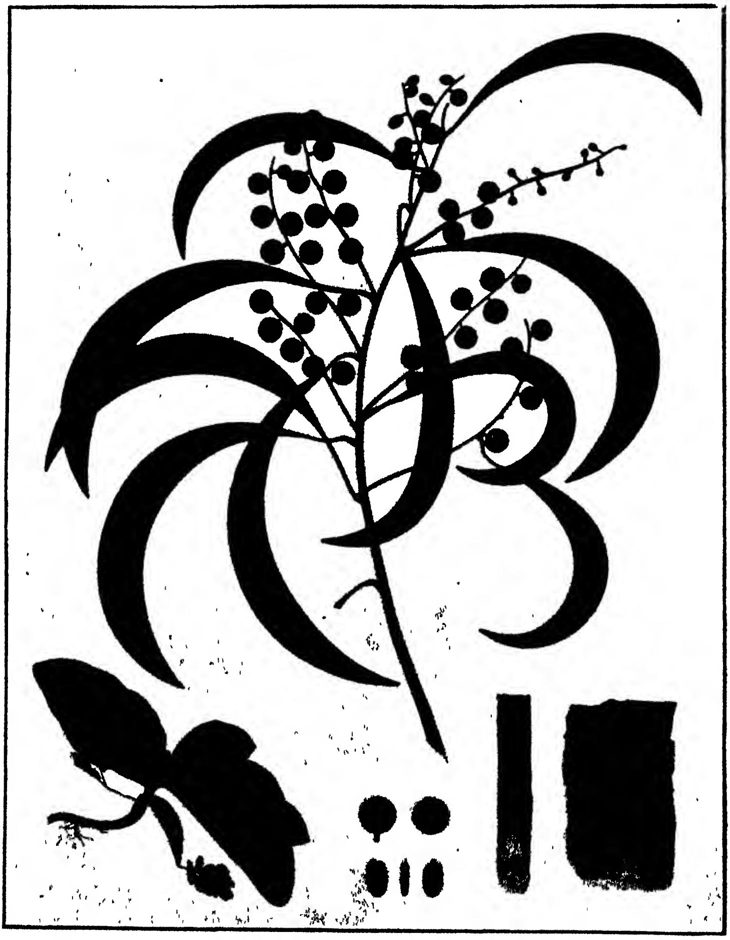
Mr. J. Blackburne, formerly Inspector, Forests Department, sends me some interesting information, from which I extract the following:—

"At Majorca, in 1882 and 1883, we put in a considerable area of *Acacia pycnantha.* The soil was a granite drift, very suitable for wattle culture. After ploughing and softening 1 lb. of seed per acre over night for the next day's sowing, each 1 lb. of seed was mixed with six small buckets of finely sifted soil, then sowed broadcast and brush-harrowed in. The first year after sowing they were

thinned by cutting out with heavy hoes to a distance of about 7 feet apart. In seven years the return of bark was about 5 tons per acre.

There are two well-marked varieties of *Acacia pycnantha.* One has a thin bark, reddish-brown in colour, the other a thick bark of a yellowish-brown tint. The latter is by far the best.

If the seed were drilled in 7 feet apart, two or three seeds in each hole, and the superfluous seedlings removed later, less seed would be required per acre.



ACACIA PYCNANTHA (GOLDEN WATTLE).

We also sowed at Majorca *A. decurrens* mixed with eucalypts, and they did splendidly, making clean straight stems up to 30 feet in height, easily stripped, and yielding bark of good quality with 35 to 40 per cent. of tannin. Wattles are grown naturally by this system.

Acacia pycnantha is rather tender, and is apt to be damaged in its young state by severe frost. If wattles alone were put in granite soil, deep, with a porous clay subsoil, I would prefer *A. decurrens*

to *A. pycnantha* (using about ¾lb. of seed per acre), although *A. mollissima* also does well in the Grampians in soil made by the wearing down of the sandstone ranges there. A good average rainfall is also a necessity for success. Plantations can be cheaply formed if there is plenty of *débris*, bracken fern, &c., on the ground, by sowing seed broadcast on the area chosen, and then letting a fire go through it. I would double the quantity of seed in such experiments, and cut out the surplus growth the first year after sowing."

For the following facts I am indebted to Mr. H. Mackay, Conservator of Forests:—

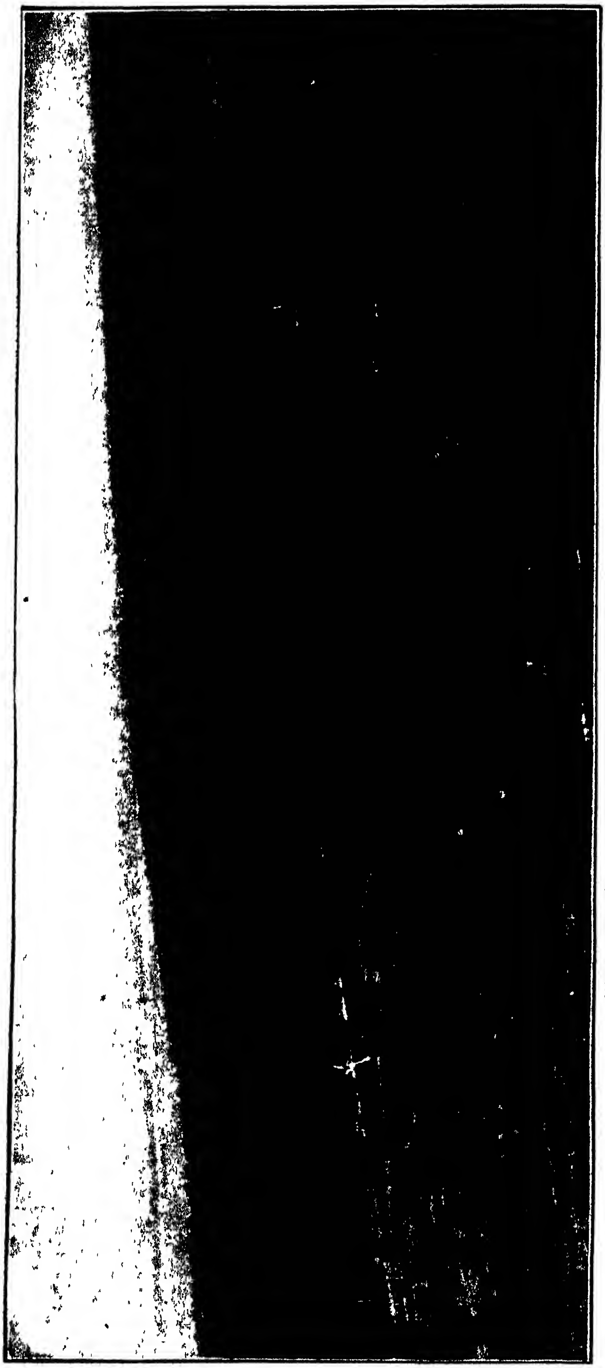
"The Forests Department has about 20,000 acres of natural wattle plantations, consisting chiefly of *Acacia mollissima*, "Late Black Wattle." These are mainly in the Victoria Valley, in the Grampians, also on the north side of Victoria Range, the same wattle covers areas of 4,000 acres or more.

The plantations made by the Department include in recent years about 5,000 acres, of which 2,500 are in the Kentbruck district, between Portland and Nelson, on the South Coast. These plantations consist almost wholly of *Acacia pycnantha*, which grows well, but suffers from cold in dry winters wherever the limestone is near to the surface. It has, however, the advantage of not being prone to the attacks of "Fire Blight." These plants are from five to six years old, and the first stripping will take place next year.

At the You Yangs, 14 miles from Geelong, is an old plantation established first in 1887 by the late Mr. Fergusson, officer in charge of the State Nursery at Macedon. Bluegum and wattle seeds were mixed and sown broadcast. This is a good method of providing a shelter belt, but if the other trees such as gums or pines are too close together, the wattles suffer. On the other hand, since the wattles are sensitive to winds and frosts, some protection is beneficial to them. In close, warm gullies, however, they are especially apt to suffer from "Fire Blight," the beetles which cause the mischief breeding especially well under moist warm conditions. For districts within 50 miles of the coast, the best wattle to plant is *A. pycnantha*, with broad, flat leaves or phyllodes, instead of the delicate foliage of the Black and Green wattles. The Golden Wattle will also grow further inland, but becomes too small in size.

The question of costs and profits depends to some extent upon freedom from disease and pests, from the ravages of fires, and upon the vicinity to markets such as Melbourne and Geelong, where large tanneries are established. In addition, the cost of hand stripping, which was formerly 30s. per ton, has now risen to £2 or £2 5s. per ton. The price of wattle-bark, which twenty-seven or thirty years ago varied from £9 to £11 per ton, now varies according to quality from £6 5s. to £7 10s. per ton. Exaggerated ideas are prevalent as to the profits to be derived from wattle plantations, and statements have been published that £10 per acre would be an average profit. Taking an average quality of poorer soils, such as granite slopes, limestone pebbles, uplands, or sandy loam, and allowing for the cost of fencing and netting to exclude sheep and rabbits for at least the first four years, the profit per acre where a plantation has been maintained successfully would be nearer £5 or £6 per acre as the results of strippings

extending from the sixth to the tenth year. Assuming a profit per sheep of 4s. to 6s. per annum by their natural increase and wool, and bearing in mind the fact that the return is quicker and the profits are obtained with less risk and greater certainty, grazing is a more profitable way of utilizing the land than wattle planting, and it will certainly not pay to convert good grazing land into wattle plantations.



GOVERNMENT WATTLE PLANTATION, LARA (YOU YANGS).

In the case of the plantation at the You Yangs, fair profits are made each year; but a private owner would need to add to his profit and loss account the interest on the capital represented by the land, and on the original cost of the plantation.

In comparing the cultivation of wattles in South Africa and in Australia, it should be remembered that the former has certain advantages. Firstly, the freight to Hamburg or London is less than from Australia. Secondly, a supply of cheap black labour is available. Thirdly, in some parts of South Africa, at least, the wattles

appear to be ready for stripping a year soner than in Victoria. There is no doubt, however, that there is a considerable amount of poor class land at present being put to no use, which might well be devoted to the cultivation of wattles. It is not likely that any one would attempt to grow wattles for profit on the carbonaceous sandstone of Gippsland, which afford rich pastures for dairying, or on fertile volcanic soils suitable for cultivation; but it may be as well to mention that wattles grown on such soils tend to be of a spindly nature, with a thin bark inferior for tanning purposes. As a rule, the best bark is obtained from granitic formations, while that from ironstone pebbles with a clay subsoil approaches and sometimes equals it. The bark from trees grown in sandy loam usually contains a little less tannic acid, but affords a good quality bark; and, in fact, yields the greater proportion of the supplies grown in Victoria.

The principal districts from which naturally grown bark is obtained are the Dartmoor district on the Lower Glenelg, the Avenel, Seymour, and Tallarook districts, the Briagolong and Glenmaggie districts in North Gippsland, and the Cunningham and Mitchell River districts in East Gippsland. The Gippsland bark is thinner, and not quite so good as that from the other localities."

The general trend of the facts mentioned above is to show that there is an opening for an increased growth of wattles for tanning bark in Victoria, but that there are certain risks attached to its profitable cultivation on a large scale, and that success is rewarded by reasonable but not extravagant profits. Apparently, the proper position is that it should enable land-owners to extract a profit from poor land they could not otherwise profitably utilize, and be more as a side line than as a mainstay of support. The cultivation of wattles does not appear to offer any openings to the man of small capital, to whom quick returns are essential.

Cream rises faster in warm milk, and also faster in cooling milk. The first is partly due to fat expanding more than water when it is warm, and the second to fat being a worse conductor of heat and cooling more slowly when the milk stands.

About 80 per cent. of the fat in milk is recovered by shallow setting, and 95 per cent. with a good machine.

GENERAL NOTES.

AGRICULTURAL CO-OPERATION IN GREAT BRITAIN.

Of late years the co-operative movement has developed in Great Britain in a notable manner, and a report recently issued by the Board of Trade states the position of affairs in 1909. Co-operative societies have been formed for various objects, such as insurance and the manufacture of dairy produce, but the most flourishing of the societies are those whose business may be described as distributive. These societies exist for the collective purchase of the manures, seeds, implements, &c., required by the members, and for the collective sale of their produce. In 1909 there were 176 such societies at work, with a membership of 17,449, as compared to 5 societies in 1895. The sales effected through the societies totalled £1,112,824, and the profit earned was £10,088. The latter is obtained as commission from members on transactions effected on their behalf, in most cases the amount charged being just sufficient to clear working expenses.

INOCULATION OF LUCERNE.

Crops all require nitrogen for their growth. An advantage possessed by lucerne and other leguminous crops is that they are not dependent on the soil for their nitrogen supply, but are able to utilize the free nitrogen of the atmosphere. It is a bacterium present in the soil which enables them to use the atmospheric nitrogen, and in doing this the bacterium forms little wart-like nodules on the roots. These nodules may be seen after digging a plant up. It sometimes happens, however, on land new to lucerne that the necessary bacterium is not present, and then no nodules are formed, and the lucerne becomes dependent on soil nitrogen like any ordinary farm crop. As lucerne requires an excessive amount of nitrogen (probably acquired character), the absence of nodule formation is peculiarly disastrous. In such cases inoculation is necessary to supply the needed bacterium. In the *Agricultural Gazette* of New South Wales, experiments are quoted from Hawkesbury showing the effect of different methods of inoculation. Tests were made of supplying pure diluted cultures of the germ to the seed and soil, and also of sprinkling some soil from an old lucerne paddock on land laid down to lucerne. The results were ascertained by counting the root nodules when the plants were about three months old. Where no inoculation was practised there were no nodules. The best results were obtained by sprinkling soil from an old paddock, 62 per cent. of the plants then showing nodules with a complete manure, and 96 per cent. where 1 ton of lime had been applied. The value of lime to lucerne can be insisted on. American experience also (*Abs. in Science,* 35 (1912). No. 893) gives the preference to soil from old well-inoculated fields rather than to the use of pure cultures which are more uncertain, presumably owing to deterioration in keeping. At Hawkesbury the soil was applied at the rate of 7 tons per acre; but although the large application may

act more quickly, small dressings of 1 or 2 cwt. will more generally be applied. Such applications cost little, and are very desirable where lucerne is languishing and shows no nodules. The inoculating soil except in dull showery weather, should be harrowed in immediately after application, as strong light will destroy the bacterium.

SILAGE FOR HORSES.

Horses and colts may be fed good sound maize silage in limited quantities, especially when not at work. When at work, silage may be fed on Saturday nights and a meal or two on Sunday. The working horse requires a stronger feed than silage, for its digestive tract is not large enough to take sufficient quantities of silage to supply the needed nutriment for doing work. Silage fed to working horses in large quantities has, to a considerable extent, the same effect as grass, which all horsemen know is weakening, although a good feed for mares suckling colts.—*Hoard's Dairyman.*

DESTRUCTION OF CHARLOCK.

The seeds of charlock or wild mustard can lie dormant for many years in the soil, and then the plant suddenly appears when the land is brought under cultivation. In a root crop the weed can be kept down by hoeing or other mechanical means, but in a cereal crop this is practically impossible, with the result that the weeds produce a fresh supply of seed which is shed and returned to the soil. Some years ago a Frenchman discovered that charlock could be destroyed by spraying with solution of copper sulphate (blue stone) without damage to the cereal crop growing along with it. Experiments were conducted in different countries as to the best strength of spray to use, the best quantity, and the time to apply it. Practical advice is given to farmers in *Leaflet 63*, issued by the Board of Agriculture, London. Good results will usually be got from 16 lbs. of copper sulphate, dissolved in 40 gallons of water, for 1 acre. Instead of copper sulphate, costing 4s. 6d., 60 lbs. of iron sulphate, costing 2s. 6d., may be used. The quantities indicated do no permanent harm to cereals, but beans or peas require a weaker application. The weed should not exceed 3 inches in height at the time of spraying. The copper sulphate should be obtained powdered to facilitate solution. The spraying machine should generate a fine spray under air pressure, and a horse machine should cover 30 to 40 acres per day. Rain immediately after spraying will interfere with success, and better results will be got in dull weather than in bright sun. Recent tests in California with iron sulphate, using 140 lbs. per acre, proved effective in killing mustard, but not wild radish. Still more recently in France, an 8 per cent. solution of sulphuric acid has been used with the best results on autumn-sown cereals. Owing to its corrosive action, however, the acid requires a special spraying machine, and on this account the copper sulphate will generally be preferred.

THE ARTIFICIAL MANURES ACTS.

UNIT VALUES FOR 1913.

By P. Rankin Scott, Chemist for Agriculture.

The amending Artificial Manures Act of 1910 requires that manufacturers or importers shall, on or before the 1st November in each year, register the brand of the several fertilizers, and at the same time supply to the Secretary for Agriculture, under declaration, the name and address of manufacturer or importer, the place of manufacture, the raw material from which the manure is manufactured or prepared, a statement of the percentages of nitrogen, phosphoric acid, and potash, together with the respective forms in which they occur, and the retail price per ton. From the information so obtained the unit values of the constituents which have a commercial value are calculated. These unit values so obtained constitute the basis of calculating the values of all manures for the period during which the registered brands continue in force, *i.e.*, until the publication in the *Government Gazette* of the list of registered brands for the following season.

A fixed limit of deficiency is allowed in all fertilizers. (See Schedule hereunder.)

When a manure on analysis is shown to contain less nitrogen, phosphoric acid, or potash than the proportions stated on the label or invoice certificate, to the extent set forth in the Schedule the vendor is liable to a fine of £10 for a first offence, and £50 for any subsequent offence.

SCHEDULE.

Description of Manure	Percentage of Deficiency allowed in regard to Ingredients of Fertilizing Value.				
	Nitrogen	Potash readily soluble	Phosphoric Acid.		
			Water soluble	Citrate soluble	Citrate insoluble.
All manures containing Nitrogen ..	0·50				
All manures containing Potash ..	..	1·00			
All manures containing Water Soluble Phosphoric Acid ..	..	..	1·00		
All manures containing Citrate Soluble Phosphoric Acid ..	..	..	..	1·00	
All manures containing Citrate Insoluble Phosphoric Acid ..	..	..	..	..	1·00

NOTE.—Provided that the total phosphoric acid deficiency shall not exceed 1·50 per cent.

Regarding the label and invoice certificate referred to above, sections 5 and 7 of the principal Artificial Manures Act of 1904 stipulate that the vendor shall attach to each bag a label or tag declaring the composition of the manure, and shall deliver to all purchasers of

manure, at the time of sale, an invoice certificate, conveying similar information to that required to be stated on the label.

From the unit values and the guarantee contained on the tags or invoice certificates, it can be readily ascertained (see method of calculation) whether the price asked for a fertilizer is a reasonable one.

In basing a valuation on mixed manures, by this method of calculation, the price asked generally exceeds the commercial value of the fertilizing ingredients contained in them, the increased cost of these mixed manures represents the cost of mixing, bagging, &c.

Artifi ial Manures Acts.

UNIT VALUES OF MANURES FOR THE YEAR 1 13 AS CALCULATED FROM THE DECLARED PRICES OF FERTILIZERS REGISTERED AT THE OFFICE OF THE SECRETARY FOR AGRICULTURE.

	s.	d.
1 per cent. of Nitrogen as Nitrate	18	6
1 per cent. of Nitrogen as Ammonia	15	7
1 per cent. of Nitrogen as Organic in Blood	15	9
1 per cent. of Nitrogen as Organic in Fine Bone	15	0
1 per cent. of Nitrogen as Organic in Coarse Bone and Bone and Dried Flesh	13	0
1 per cent. of Phosphoric Acid as Water Soluble	4	9
1 per cent. of Phosphoric Acid as Citrate Soluble	4	6
1 per cent. of Phosphoric Acid as Fine Bone	4	6
1 per cent. of Phosphoric Acid as Coarse Bone	3	6
1 per cent. of Phosphoric Acid as Insoluble, in Bone Superphosphates, Bone Fertilizers, and Thomas Phosphates	3	0
1 per cent. of Phosphoric Acid as Insoluble in all other Manures	2	0
1 per cent. of Potash as Nitrate	7	0
1 per cent. of Potash as Sulphate	5	8
1 per cent. of Potash as Chloride	4	10

NOTE.—Potash in Kainit is valued as Sulphate.

Method of Calculating the Value of a Manure.

The value per ton of a manure sold in Victoria is obtained by multiplying the percentages stated of the fertilizing substances by the corresponding unit values fixed therefor, and adding the separate values together.

As per example:—

		£	s.	d.
1. Nitrate of Soda—				
Invoice certificate on tag ..	15·5 per cent. of Nitrogen.			
Calculation—				
15·5 x 18s. 6d. = ..		14	8	4
Calculated value per ton ..		14	8	4

		£	s.	d.
2. Superphosphate—				
Invoice certificate on tag—				
Water Soluble Phosphoric Acid	17·00 per cent.			
Citrate Soluble Phosphoric Acid	1·00 ,,			
Insoluble Phosphoric Acid ..	2·00 ,,			
Total Phosphoric Acid ..	20·00 ,,			
Calculation—				
Phosphoric Acid (Water Soluble), 17 x 4s. 9d.		4	1	9
Phosphoric Acid (Citrate Soluble), 1 x 4s. 6d.		0	4	6
Phosphoric Acid (Citrate Insoluble), 2 x 2s.		0	2	0
		4	8	3

		£	s.	d.
3. Bonedust—				
Invoice certificate on tag				
Nitrogen ..	3·00 per cent.			
Phosphoric Acid ..	20·00 ,,			
Mechanical condition—				
Fine bone ..	40·00 ,,			
Coarse bone ..	60·00 ,,			
Calculation—				
Nitrogen—Fine bone $\frac{3\cdot0 \times 40}{100}$ = 1·20 x 15s.		0	18	0
Nitrogen—Coarse bone, $\frac{3\cdot0 \times 60}{100}$ = 1·80 x 13s.		1	3	5
Phosphoric Acid—Fine bone, $\frac{20 \times 40}{100}$ = 8·00 x 4s. 6d.		1	16	0
Phosphoric Acid—Coarse bone, $\frac{20 \times 60}{100}$ = 12·00 x 3s. 6d.		2	2	0
		5	19	5

		£	s.	d.
4. Mixed Manure—				
Invoice certificate on tag—				
Nitrogen as Ammonia ..	2·00 per cent.			
Phosphoric Acid (Water Soluble) ..	10·00 ,,			
Phosphoric Acid (Citrate Soluble) ..	1·00 ,,			
Phosphoric Acid (Citrate Insoluble) ..	2·00 ,,			
Phosphoric Acid Total ..	13·00 ,,			
Potash as Sulphate ..	7·50 ,,			
Calculation—				
Nitrogen as Ammonia, 2·0 x 15s. 7d. ..		1	11	2
Phosphoric Acid (Water Soluble), 10 x 4s. 9d. ..		2	7	6
Phosphoric Acid (Citrate Soluble), 1 x 4s. 6d. ..		0	4	6
Phosphoric Acid (Citrate Insoluble), 2 x 2s. ..		0	4	0
Potash as Sulphate, 7·50 x 5s. 8d. ..		2	3	6
		6	10	8

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS.

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Potash.	Price asked for the Manure per ton. £	s.	d.	Where Obtainable.
		%	%	%	£	s.	d.	
Mainly Nitrogenous.								
Sulphate of Ammonia	Federal A S.	20·00	.	.	16	0	0	Australian Explosives and Chemical Co. Ltd., Melbourne
" "	Sickle	20 00	.	.	16	0	0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" "	Hasell's	20·00		..	15	17	6	A. H Hasell, Melbourne
" "	M.G. Co.	20·00		.	14	0	0	Metropolitan Gas Co., Melbourne
" "	M.L.	20·00	.	.	16	0	0	Mt. Lyell M. and R. Co Ltd., Melbourne
" "	Wischer's	20 00	.	.	16	0	0	Wischer and Co. Prop Ltd., Melbourne
Nitrate of Soda	Federal S.N.	15·50	.		14	10	0	Australian Explosives and Chemical Co. Ltd., Melbourne
"	Sickle	15 50			14	10	0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
"	Hasell's	15·50	.		14	5	0	A. H Hasell, Melbourne
"	M.L.	15·50	.		14	10	0	Mt. Lyell M and R. Co. Ltd., Melbourne
"	Wischer's	15·50	.		14	10	0	Wischer and Co. Prop. Ltd., Melbourne
Blood	Imperial	11·50	1·00	0 18	9	15	0	W. Angliss and Co. Prop. Ltd., Melbourne
"	Federal Blood	7 50	1·00	..	6	10	0	Australian Explosives and Chemical Co. Ltd., Melbourne
"	Champion	11 00	2·00		7	15	0	John Cooke and Co., Melbourne
"	Sickle	7·50	1·00		6	10	0	Cuming, Smith, and Co. Prop Ltd., Melbourne
"	M C.C.	7·50	1·00	0 41	4	8	9	Melbourne City Council, Melbourne
Blood, "A"	M.L.	11·00	..		10	0	0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Blood, "B"	..	7·50	1·00	.	6	10	0	" " " "
Blood and Bone	..	6·50	6·20	..	6	15	0	" " " "
Blood	Wischer's	7·50	1 00	..	6	10	0	Wischer and Co. Prop. Ltd., Melbourn
Mainly Potassic.								
Kainit	Sickle	..	.	12·40	5	0	0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
"	M L.	..	.	12·40	5	0	0	Mt. Lyell M. and R. Co. Ltd., Melbourne
"	Wischer's	..		12·40	5	0	0	Wischer and Co. Prop. Ltd., Melbourne
Nitrate of Potash	Sickle	13 00	.	46 00	28	0	0	Cuming, Smith and Co. Prop. Ltd., Melbourne
" "	M.L.	13 00		46 00	28	0	0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Potash Chloride (Muriate)	Federal P.M.	.	.	60 00	14	10	0	Australian Explosives and Chemical Co. Ltd., Melbourne
" "	Sickle	.		60 00	14	10	0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" "	Hasell's	.	.	60 00	14	5	0	A. H. Hasell, Melbourne
" "	M.L.	.	.	60·00	14	10	0	Mt. Lyell M. and R. Co. Ltd., Melbourne
" "	Wischer's		.	60 00	14	10	0	Wischer and Co. Prop. Ltd., Melbourne
Potash Sulphate	Federal P.S.	.	..	52 00	14	12	6	Australian Explosives and Chemical Co. Ltd., Melbourne
"	Sickle	..	..	52 00	14	12	6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
"	Hasell's	..	..	52 00	14	10	0	A. H. Hasell, Melbourne
"	M L	..	..	52·00	14	12	6	Mt. Lyell M. and R. Co. Ltd., Melbourne
"	Wischer's			52 00	14	12	6	Wischer and Co. Prop Ltd., Melbourne

List of Fertilizers Registered at the Office of Secretary for Agriculture under the Artificial Manures Acts—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. In-soluble.	Phosphoric Acid. Total.	Potash.	Price asked for the Manure per Ton.	Where Obtainable.
		%	%	%	%	%	%	£ s. d.	
Mainly Phosphoric, Phosphoric Acid easily Soluble.									
Concentrated Superphosphate	Federal Con. S.	..	40·00	4·00	..	44·00	..	12 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,, ,, ,,	Sickle	..	40·00	4·00	..	44·00	..	12 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,, ,,	M.L.	..	40·00	4·00	..	44·00	..	12 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
,, ,, ,,	Wischer's ..	..	40·00	4·00	..	44·00	..	12 10 0	Wischer and Co. Prop. Ltd., Melbourne
Superphosphate ..	Federal O.S. .	..	17·00	1·00	2·00	20 00	.	4 7 6	Australian Explosives and Chemical Co. Ltd., Melbourne
,, ..	Cockbill's ..	.	17·00	1 00	2·00	20 00	..	4 10 0	J. Cockbill, Melbourne
,, ..	Sickle Florida ..	..	17·00	1·00	2·00	20 00		4 7 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ..	Hasell's .	..	17·50	0·50	2·00	20·00	..	4 7 6	A. H. Hasell, Melbourne
Superphosphate, No. 1 ..	M.L.	..	17·00	1·00	2·00	20 00		4 7 6	Mt. Lyell M and R. Co. Ltd., Melbourne
Superphosphate ..	Rohs	..	16·85	1·70	0·45	19 00		4 12 6	P. Rohs, Bendigo
Superphosphate, No. 1 ..	Wischer's ..	..	17·00	1·00	2 00	20·00	.	4 7 6	Wischer and Co. Prop. Ltd.' Melbourne
Containing Nitrogen also.									
Nitro Superphosphate ..	Sickle .. .	1·25	15·30	0·90	2·55	18·75	..	5 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,, ..	Hasell's ..	1·50	13·00	1·00	3·00	17 00	..	5 8 6	A. H. Hasell, Melbourne
,, ,, ..	M.L.	1·60	13·00	1·00	2·00	16 00	..	5 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
,, ,, ..	Wischer's ..	1·50	13·18	1·52	2 30	17·00	.	5 10 0	Wischer and Co. Prop Ltd. Melbourne
,, ,, ..	Federal Nitro .	1·10	13 00	1·00	5·00	19 00	..	5 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Blood, Bone, and Superphosphate	Federal B.B.S ..	2·62	8·50	0·50	5 00	14·00	..	6 0 0	,, ,, ,, ,,
Blood, Bone, and Superphosphate, "B"	Sickle	2·62	8·50	0 50	5 00	14·00	.	6 0 0	Cuming, Smith, and Co Prop. Ltd. Melbourne
Blood, Bone, and Superphosphate	M L.	2·62	8·50	0 50	5 00	14·00	..	6 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
,, ,, ,,	Wischer's ..	2·63	8·50	0·50	5·00	14·00	..	6 0 0	Wischer and Co. Prop. Ltd., Melbourne

Dissolved Bone and Superphosphate	Sickle	1·00	10·01	3 88	5 48	19·37	..	5 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " "	M.L.	1·00	10·00	3 75	5 25	19·00		5 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " "	Wischer's .	1·00	10 01	3·88	4·78	18 67		5 10 0	Wischer and Co. Prop. Ltd., Melbourne
Bone and Superphosphate, 1 and 3	Federal B.S., No. 3	0·75	12 75	0·75	5·50	19 00	.	5 5 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Bone and Superphosphate, 1 and 1	Federal B.S., No. 1	1·50	8 50	0 50	9·00	18 00		5 12 6	" " " "
Bone and Superphosphate, 3 and 1	Federal B.S. (D) ..	2·25	4 25	0 25	12·50	17·00	.	6 0 0	" " " "
Bone and Superphosphate	S. and F. Bugg ..	1·45	8 05	7·20	5 05	20·30	.	5 15 0	F. and S. Bugg, Kyneton
" "	Cockbill's .	1·75	12 00	2·00	4·50	18·50		5 5 0	J. Cockbill, Melbourne
Bone and Superphosphate, 1 and 3	" .	1·50	12·75	1·50	4·75	19·00	.	5 5 0	" "
Bone and Superphosphate, "A"	Sickle . ..	1·50	8·50	0·50	9 00	18 00		5 12 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Bone and Superphosphate, "C"	"	0 75	12·75	0·75	5 50	19 00		5 5 0	" " " "
Bone and Superphosphate, "D"	"	2·25	4 25	0·25	12·50	17 00		6 0 0	" " " "
Bone and Superphosphate 1 and 3	Hasell's ..	0 80	12·75	1 25	5 50	19 50	.	5 4 0	A. H. Hasell Melbourne
Bone and Superphosphate, 1 and 1	" .	1·50	9 00	1·00	9 50	19 50		5 10 0	" " "
Bone and Superphosphate, No. 1	M.L. .. .	1 50	8 50	0·50	9 00	18 00		5 12 6	Mt Lyell M. and R. Co. Ltd., Melbourne
Bone and Superphosphate, No. 2	" .. .	0 75	12·75	0·75	5 50	19 00	..	5 5 0	" " " "
Bone and Superphosphate, No. 3	" . ..	2·25	4 25	0·25	12 50	17 00	.	6 0 0	" " " "
Animal Fertilizer and Superphosphate	A.N.A. Surprise .	1·50	7·59	2 95	5 51	16 05	.	5 10 0	G. W. Pennell, Deer Park
Bone and Superphosphate	Rohs .. .	1 50	8·00	4·00	5 50	17 50	.	5 5 0	P. Rohs, Bendigo
Bone and Superphosphate. No. 1	Wischer's .	1 50	8·50	0·50	9 00	18 00	.	5 12 6	Wischer and Co. Prop. Ltd., Melbourne
Bone and Superphosphate, No. 2	" ..	0 75	12·75	0 75	5 50	19 00	.	5 5 0	" " " "
Bone and Superphosphate, No. 3	" ..	2·25	4·25	0·25	12·50	17 00	..	6 0 0	" " " "
Phosphoric Acid moderately Soluble.									
Thomas Phosphate ..	Federal .	..	..	14·00	3·00	17·00	..	4 7 6	Australian Explosives and Chemical Co. Ltd., Melbourne
" " ..	Sickle	.	.	14·00	3·00	17·00	.	4 7 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " ..	Hasell's .	.	..	14·00	3·50	17·50	..	4 2 6	A. H. Hasell, Melbourne
" " ..	M.L.	..	..	14 00	3·00	17 00	.	4 7 6	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " .	Wischer's .			14·00	3·00	17 00	..	4 7 6	Wischer and Co. Prop. Ltd., Melbourne

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS—*continued.*

Description of Manure	Brand.	Nitrogen	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. In-soluble	Phosphoric Acid. Total	Potash.	Price asked for the Manure per ton.	Where Obtainable.
Phosphoric Acid difficultly Soluble.		%	%	%	%	%	%	£ s d	
Bone Fertilizer ..	Federal B.F. Special	5·00	..	3·00	12 00	15·00		7 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,, ,, ..	Federal B.F. ..	3 00	.	3 00	13 00	16 00		6 2 6	,, ,, ,, ,,
,, ,, ..	S. and F. Bugg ..	3·58	..	5 67	15 78	21 45		6 0 0	S and F Bugg, Kyneton
,, ,, ..	Cockbill's .	3·50	..	3 50	14 75	18 25		5 10 0	J. Cockbill, Melbourne
Bone Manure ..	,, .	6·00		5 00	10 00	15 00		7 0 0	,, ,,
Animal Fertilizer .	Champion ..	6·00		5 40	3 91	9 30		5 15 0	J. Cooke and Co., Melbourne
Bone Fertilizer .	Sickle ..	3 00		3 00	13 00	16 00		6 2 6	Cuming, Smith and Co. Prop. Ltd., Melbourne
Bone Fertilizer, Special .	,, ..	5 00		3 00	12·00	15 00		7 0 0	,, ,, ,, ,,
Bone Fertilizer ..	Elsworth ..	3·00		6 00	11 00	17 00		5 12 6	Exrs. J. R. Elsworth, Ballarat East
,, ,, ..	Horseshoe .	3·50	.	4 70	10 70	15 40		5 10 0	P. Fitzgerald, Bentleigh
Bone Fertilizer, Special .	Magic ..	5 00		3 00	10 00	13 00		6 0 0	G. Gardiner and Co. Prop. Ltd., Geelong
Bone Fertilizer ..	Magic No. 1 ..	2·00	..	6 58	10 42	17 00		5 2 6	,, ,, ,, ,,
,, ,, ..	Magic No. 2 ..	1·50	..	3 10	12 90	16 00		4 17 6	,, ,, ,, ,,
Bone Fertilizer, "A" ..	Hasell's .	4 25	..	5 00	14 00	19 00		6 18 6	A. H. Hasell, Melbourne
Bone Fertilizer, "B" ..	,, .	3 48	.	3 77	15·43	19 20		6 12 6	,, ,,
Bone Fertilizer "C" .	,,	2·52	.	2 73	15 51	18 24		5 12 6	,, ,,
Bone Fertilizer ..	Echuca ..	5·12	..	3 75	11 50	15 25	.	5 10 0	Milo Bacon Co., Echuca
Bone Fertilizer, "A" ..	M.L. ..	5 00	..	3 00	12 00	15·00		7 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Bone Fertilizer, "B" .	,, ..	3 00	..	3 00	13 00	16 00		6 2 6	,, ,, ,, ,,
Bone Fertilizer ..	Ark .	3 69	..	6 68	10 27	16 95		6 0 0	A. Murphy, Ararat
Animal Fertilizer .	A.N.A. Surprise .	3 00	..	6 00	9 00	15 00		5 10 0	G. W. Pennell, Deer Park
,, ,, ..	Wifco .	7 50	..	5 50	4·00	9 50		6 0 0	Wimmera Inland Freezing Co. Ltd., Murtoa
Bone Fertilizer, Special .	Wischer's .	5 00	..	3 00	12 00	15 00	..	7 0 0	Wischer and Co. Prop. Ltd., Melbourne
Bone Fertilizer .. .	,, ..	3 00	.	3 00	13 00	16 00	.	6 2 6	,, ,, ,, ,,
Blood and Bone Fertilizer	Federal B. & B	5 25	..	1 50	7 00	8 50	.	6 15 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,, ,, ,,	Sickle .. .	5 25	.	1 50	7 00	8 50	.	6 15 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,, ,,	Wischer's .	6 00	..	..	6 70	6·70	..	6 15 0	Wischer and Co. Prop. Ltd., Melbourne

Ground Phosphate ..	Federal G.P. ..	..	..	..	36·65	36·65	..	5 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Pacific Island Guano ..	A.G.C. Flag ..	0·35	..	4·80	10 70	15 50	..	3 15 0	H. B. Black and Co., Melbourne
Maldon Island Guano ..	Sickle	..	..	..	22·90	22 90	..	4 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Ground Phosphate ..	"	..	..	..	36 65	36·65	..	5 0 0	" " " "
Guano .. .	Hasell's .	.	..	..	27 50	27·50	.	4 0 0	A. H. Hasell, Melbourne
"	M.L. .. .	..	..	..	23 00	23 00		4 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Ground Phosphate ..	" .. .	.	.	..	36·65	36·65		5 0 0	" .. " "
Guano	Wischer's ..	..	..	..	23 00	23·00		4 0 0	Wischer and Co. " Prop." Ltd., Melbourne
Ground Phosphate ..	" .	..	.	.	36 50	36 50	..	5 0 0	" " " "
Containing Nitrogen, Phosphoric Acid, and Potash.									
Sugar Beet Manure .	Federal Beet	4·50	11 00	0 75	1 25	13·00	5 50	8 12 6	Australian Explosives and Chemical Co. Ltd, Melbourne
Top Dressing, Grass ..	Federal T.D .	1 60	11 00	0 64	1 30	12 94	1·50	5 5 0	" " " "
Grass Laying Manure .	Federal G L	0 50	11 00	0 64	6 30	17 94	2 00	5 5 0	" " " "
Horticultural Manure	Federal H M	2 50	11·62	0 68	1 38	13 68	10 00	9 0 0	" " " "
Maize Manure .	Federal M Z	2 36	10 20	0 60	6 20	17 00	2 00	6 7 6	" " " "
Onion Manure	Federal M G.	2 00	11·00	0 64	1 30	12 94	5 00	6 7 6	" " " "
Orchard Manure ..	Federal F M .	1 80	13 22	0·78	1 55	15 55	8·00	7 7 6	" " " "
Pea, Bean, and Clover Manure	Federal P.B	0 50	10 00	0 60	4 20	14 80	3 00	5 5 0	" " " "
Potato Manure ..	Federal Potato	1 00	14 00	0 80	1 64	16 44	5 00	6 7 6	" " " "
Rape Manure .. .	Federal Rape	0 98	10·50	0 62	4 18	15 30	2 00	5 10 0	" " " "
Vine Manure .. .	Federal V S P. .	7 00	7 15	0·42	0 84	8 41	12 00	12 10 0	" " " "
Mildura A. and P., No. 1	Sickle . .	3·46	9 41	0 55	1 10	11 06	11·60	9 7 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Mildura Citrus, No. 1 .	" .	1 39	3 79	0 22	7 87	11 88	16 25	8 15 0	" " " "
Grass Manure	" . ..	0·30	11 05	0·65	8·85	20·55	3·00	5 5 0	" " " "
Horticultural Manure ..	"	4·00	11 22	0·66	1·32	13·20	8·40	9 0 0	" " " "
Maize Manure	"	2·20	14·62	0 86	1·72	17·20	1·80	6 7 6	" " " "
Onion Manure	"	2·00	13·60	0·80	1·60	16·00	3·60	6 7 6	" " " "
Orchard Manure ..	"	2·40	12 92	0·76	1·52	15·20	7 20	7 7 6	" " " "
Potato Manure, "A" ..	"	1·30	8·00	3 10	5·88	16 98	5·20	7 0 0	" " " "
Potato Manure, "B" ..	"	1·20	14·62	0·86	1·72	17·20	4 16	6 7 6	" " " "
Rose Manure	"	3·94	6·18	0 36	0 72	7·26	13 94	12 0 0	" " " "
Vine Manure	"	2·40	12·92	0·76	1·52	15·20	7·20	7 7 6	" " " "
Vine Manure, "B" ..	"	1·25	10·62	0·63	5·00	16·25	7·50	6 15 0	" " " "
Mildura Vine, No. 1 ..	"	5·53	7·14	0·42	0·84	8·40	11·60	10 15 0	" " " "
Mildura Vine, No. 3 ..	" . ..	7·14	7·14	0·42	0 84	8·40	11·60	11 2 6	" " " "
Dissolved Peruvian Guano	Ohlendorff ..	5·73	11·95	..	0·81	12·76	1·47	13 5 0	Gibbs, Bright, and Co., Melbourne
Sugar Beet Manure ..	Hasell's .	4·00	11·00	0·75	1·25	13·00	8·20	8 17 6	A. H. Hasell, Melbourne
Fodder Crop Manure ..	" ..	3·00	11·50	1·25	1·50	14·25	1 00	6 6 6	" "
Lawn Manure .. .	" ..	0·40	11·25	1·00	8·50	20·75	2·50	5 5 0	" "
Grass Manure .. .		0·40	11·25	1·00	8·50	20·75	2·50	5 5 0	.. "

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. In-soluble.	Phosphoric Acid. Total.	Potash.	Price asked for the Manure per ton.	Where Obtainable.
***Containing Nitrogen, Phosphoric Acid, and Potash*—continued.**		%	%	%	%	%	%	£ s. d.	
Horticultural Manure ..	Hasell's	3·80	11·00	0·50	2 00	13·50	8 00	8 15 0	A. H. Hasell, Melbourne
Maize Manure	,, ..	3 00	11·50	1·25	1·50	14·25	1·00	6 6 6	,, ,,
Onion Manure	,, ..	3 00	9·50	1·00	1·50	12·00	3·06	6 6 6	,, ,,
Orchard Manure ..	,, ..	2·00	14·00	0·75	0·25	15·00	7·14	7 7 6	,, ,,
Potato Manure	,, ..	1·00	12·75	0·75	2·00	15·50	6·00	6 5 0	,, ,,
Root Crop Manure ..	,, ..	3 20	7·00	1·00	2·50	10·50	4·50	6 15 0	,, ,,
Tomato Manure ..	,, ..	3·80	11·00	0 50	2·00	13·50	8·00	8 15 0	,, ,,
Vine Manure	,, ..	2·00	14·00	0·75	0·25	15·00	7·14	7 7 6	,, ,,
Apricot and Peach, No. 1 Mildura	M.L.	4·46	9·41	0·55	1·10	11·06	11·57	9 12 6	Mt. Lyell M. and R. Co. Ltd., Melbourne
Citrus, No. 1 Mildura ..	,, ..	1 39	3·61	0·21	7·82	11·64	16·88	8 17 6	,, ,, ,, ,,
Fodder Crop Manure ..	,, ..	3·00	11·00	1·25	1·75	14·00	1·00	6 7 6	,, ,, ,, ,,
Grass Manure ..	,, ..	0·30	11·05	0·65	9·05	20·75	2·70	5 5 0	,, ,, ,, ,,
Horticultural Manure ..	,, ..	4·00	11·00	0·75	1·45	13·20	8·25	9 0 0	,, ,, ,, ,,
Maize Manure	,, ..	3·00	11·00	1·25	1·75	14·00	1·00	6 7 6	,, ,, ,, ,,
Onion Manure	,, ..	3·00	9·50	1·00	1·50	12·00	3·00	6 7 6	,, ,, ,, ,,
Orchard Manure ..	,, ..	2·35	13·00	0·75	1·50	15·25	7·20	7 7 6	,, ,, ,, ,,
Potato Manure	,, ..	1·20	14·50	1·00	1·70	17·20	4·15	6 7 6	,, ,, ,, ,,
Potato Manure with Bone	,, ..	1·05	8·50	0·50	7·30	16·30	8·80	7 0 0	,, ,, ,, ,,
Rape Manure	,, ..	1·20	13·00	1·00	2·00	16·00	1·00	5 10 0	,, ,, ,, ,,
Root Crop Manure ..	,, ..	3·25	7·25	1·00	2·00	10·25	4·75	6 17 6	,, ,, ,, ,,
Rose Manure	,, ..	4·00	6·50	0·50	0·50	7·50	14·00	12 0 0	,, ,, ,, ,,
Tomato Manure ..	,, ..	4·00	11·00	0·75	1·45	13·20	8·25	9 0 0	,, ,, ,, ,,
Vine Manure ..	,, ..	2·35	13·00	0·75	1·50	15·25	7·20	7 7 6	,, ,, ,, ,,
Vine, No. 1 Mildura ..	,, ..	5·53	6·98	0·41	0·82	8·21	12·07	10 15 0	,, ,, ,, ,,
Vine, No. 3 Mildura ..	,, ..	7·14	6·98	0·41	0·82	8·21	12·07	11 5 0	,, ,, ,, ,,
Vine, No. 5 Mildura ..	,, ..	1·00	5·67	0·34	6·00	12·01	17·33	8 15 0	,, ,, ,, ,,
Vine, No. 6 Mildura ..	,, ..	1·12	6·37	0·38	6·75	13·50	13·00	7 17 6	,, ,, ,, ,,
Market Gardener's Manure	Wischer's ..	3 38	9·35	0·55	1·10	11·00	6·50	7 7 6	Wischer and Co. " Prop. " Ltd. Melbourne
Grass Manure	,, ..	0·75	9·80	0·75	5 15	15·70	2·60	5 5 0	,, ,, ,, ,,
Key Fertilizer for Grass ..	,, ..	0·50	15·30	0·90	1·80	18·00	2·60	5 15 0	,, ,, ,, ,,
Hop Manure	,, ..	2·00	14·00	1·00	1·00	16·00	5·00	7 2 6	,, ,, ,, ,,
Horticultural Manure ..	,, ..	3·00	11·25	0·70	1·30	13·25	9·70	9 0 0	,, ,, ,, ,,
Maize Manure	,, ..	1·75	14·65	0·85	1·75	17·25	2·60	6 7 6	,, ,, ,, ,,
Onion Manure	,, ..	2·50	9·15	0·95	1·58	11·68	4·50	6 7 6	,, ,, ,, ,,
Nurseryman's Plant Food	,, ..	5·00	8·50	0·50	1·00	10·00	13·00	12 0 0	,, ,, ,, ,,

Orchard Manure ..	Wischer's ..	3·38	9·35	0·55	1·10	11·00	6·50	7 7 6	Wischer and Co. Prop. Ltd., Melbourne
Potato Manure	,, ..	0·94	12·97	0·76	1·52	15·25	5·85	6 7 6	,, ,, ,, ,,
Potato Manure with Bone	,, ..	1·05	8·50	0·50	6·60	15·60	7·78	7 0 0	,, ,, ,, ,,
Rape Manure	,, ..	1·05	8·50	0 50	6·60	15·60	7·78	7 0 0	,, ,, ,, ,,
Rose Manure	,, ..	7·75	4·45	0·25	0·55	5·25	18·15	12 0 0	,, ,, ,, ,,
Vine Manure	,, ..	3·00	8·50	0·95	1·45	10·90	7·65	7 7 6	,, ,, ,, ,,
Containing Nitrogen and Phosphoric Acid.									
Mildura A. and P., No. 2	Sickle .. .	4·45	12·11	0·71	1·42	14·24	..	7 12 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Mildura Citrus, No. 2 ..	,, ...	2·02	5·52	0·32	11·45	17·29	..	5 17 6	,, ,, ,, ,,
Top Dressing, Grass ..	,, ...	0·70	16·40	0·97	1·93	19·30	..	5 5 0	,, ,, ,, ,,
Rape Manure	,, ...	1·25	15·30	0·90	2·55	18·75	..	5 10 0	,, ,, ,, ,,
Mildura Vine, No. 2 ..	,, ...	7·13	9·18	0·54	1·08	10·80	..	9 7 6	,, ,, ,, ,,
Mildura Vine, No. 4 ..	,, ...	9·20	9·18	0·54	1·08	10·80	..	10 0 0	,, ,, ,, ,,
Rape Manure	Hasell's ..	1·20	14·25	1·00	2 25	17·50	..	5 7 6	A. H. Hasell, Melbourne
Apricot and Peach, Mildura No. 2	M.L.	5·75	12·11	0·71	1·42	14·24	..	8 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Citrus, No. 2 Mildura ..	,, ...	2·02	5·54	0·33	11·43	17·30	..	5 17 6	,, ,, ,, ,,
Vine, No. 2 Mildura ..	,, ...	7·18	9·18	0·54	1·08	10·80	..	9 7 6	,, ,, ,, ,,
Vine, No. 4 Mildura ..	,, ...	9·20	9·18	0·54	1·08	10·80	..	10 0 0	,, ,, ,, ,,
Containing Phosphoric Acid and Potash.									
Special Grain Manure ..	Federal S.G. .	..	16·50	1·00	2·00	19 50	0·75	5 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Leguminous Manure ..	Sickle	..	15·30	1·00	1·90	18·20	2·60	5 5 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,, ..	Hasell's ..	..	12·00	1·00	3·00	16·00	4·59	5 5 0	A. H. Hasell, Melbourne
Lawn Manure	M.L.	..	7 00	11·00	1·00	19·00	2·00	5 5 0	Mt. Lyell M. and R. Co. Ltd.. Melbourne
Grass Manure	,, ...	..	7·00	11·00	1·00	19·00	2·00	5 5 0	,, ,, ,, ,,
Leguminous Manure ..	,, ...	..	15·30	1·00	1 90	18·20	2·60	5 5 0	,, ,, ,, ,,
Pea Manure	Wischer's .	..	14·45	0·85	1·70	17·00	7·78	6 10 0	Wischer and Co. " Prop." Ltd., Melbourne
Leguminous Manure ..	.. ..	..	15 30	1 00	1 90	18·20	2·60	5 5 0	.. .. .. ,,

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Mechanical Condition. Fine.	Mechanical Condition. Coarse.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	%	£ s. d.	
Containing Phosphoric Acid and Nitrogen, Phosphoric Acid moderately Soluble.							
Bonedust	Lara .. .	3·50	19·10	32·80	67·20	5 5 0	J. W. Branch, Geelong
,, ...	Ox . .	3·15	22·00	33·00	67·00	6 0 0	J. L. Brown, Hamilton
Bonemeal	Sickle ..	3·00	21·00	30·00	70·00	7 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Bonedust	Elsworth ..	4·00	19·00	30·00	70·00	6 10 0	Exrs. J. R. Elsworth, Ballarat East
,, ...	Horseshoe	3·75	15·40	52·20	47 80	6 0 0	P. Fitzgerald, Bentleigh
,, ...	Hasell's .. .	4·75	19 00	55·00	45 00	7 5 0	A. H. Hasell, Melbourne
Bone and Blood	,, .. .	5·50	17·00	40·00	60·00	7 10 0	,, ,,
Bonedust	Bullock .. .	2·00	17·00	30·00	70·00	6 0 0	Heinz Bros. Prop. Ltd., Ballarat
,, ...	Vauxhall .. .	3·86	23·25	33·70	66·30	6 10 0	Wm. Moore, Panmure
Bonemeal	M.L. .. .	3·00	21·00	30·00	70·00	7 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Bonedust	White Horse ..	2·50	24·30	60·00	40·00	5 0 0	F. W. Richards, Warrenheip
,, ...	Rohs .. .	4·00	18·00	66·00	34·00	5 15 0	P. Rohs Bendigo
,, ...	Brown Hill .	2·50	18·00	30·00	70·00	6 0 0	Turner Bros., Ballarat East

Government Agricultural Laboratory,
21st November, 1912

P. RANKIN SCOTT,
Chemist for Agriculture.

COOL STORAGE ON THE FARM.

By G. H. F. Baker, Dairy Supervisor.

During the hot summer months many farmers find it difficult to keep their cream, even when sent daily to the butter factory, in that condition which is essential for the production of superfine butter and as quality is one of the factors which determine price, it is to their interest to supply the factory with a fresh article. To do this it is necessary, immediately after separating, to reduce the temperature of the cream as low as possible, and keep it so. Without the aid of a refrigerator or ice this is a difficult matter in most cases.

On some farms, in country like the Beach Forest, where springs are abundant, water is conveyed by pipes from the spring to the water tank and the cream cans placed in running water of a low temperature.

Another but less efficient method is to stand the cans in water; but as the water absorbs heat from the atmosphere it is not many hours before it becomes almost as hot as the air and the good effect nullified, with consequent deterioration in the quality of the cream and low price for same.

A cheap and effective cool safe that has proved a perfect boon in the hot, dry districts can be made at a little cost with a few battens, some hessian, and sufficient galvanized iron to make a shallow dish. This safe will keep the cream fresh, and prevent contamination by flies, dust, &c. The size will depend upon the quantity of the material required to be stored. The builder will, therefore, be wise if he constructs a safe somewhat larger than the anticipated necessary requirements. It will cost little more, and guard against overtaxing the accommodation during the months of heavy production.

The principle of the safe described in this article is the same as occurs in the canvas water bag which as is well known keeps the contained water at a much lower temperature than the surrounding atmosphere by virtue of the evaporation taking place. In this safe water is syphoned from a basin on the top—by means of strands of wool this flows over the hessian lining keeping it continually moist and the contents cool and fresh.

Such a safe will prove a boon to the women folk by adding to the comforts of farm life in keeping the meat, butter, milk, and other perishable products fresh and cool in the hot, dry months of summer. As it is not wise to store anything else in the same safe with the cream, it would be advisable to make two—one for cream storage and one for other products.

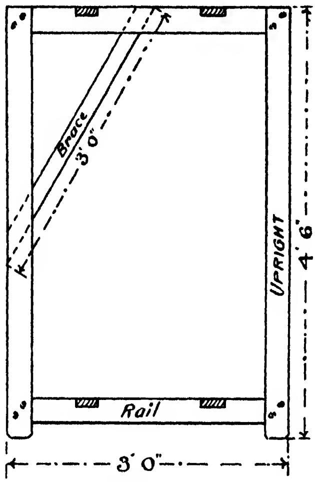
Method of Construction.

All the material is constructed of 3-in. x 1-in. uprights and rails, and 2-in. x 1-in. braces.

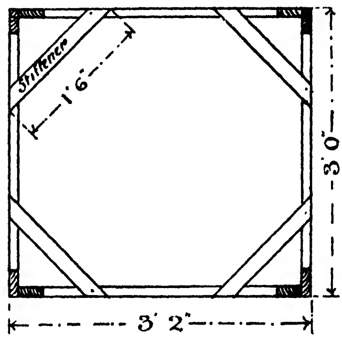
Each side consists of two uprights 4 ft. 6 in. long, two rails 3 feet long, and one brace 3 feet long. The brace for framework of front in which door is hung will be only 18 inches long, and will act as stop to door.

The uprights and rails are framed together as shown in drawing No. 1; the joints are halved together and screwed with two screws to each joint, and the brace is firmly screwed on the back.

The four sides having been made are placed together, forming a square 3 feet x 3 ft. 2 in., as shown in drawing No. 2; the sides are nailed together at the corners, and each corner is stiffened at top



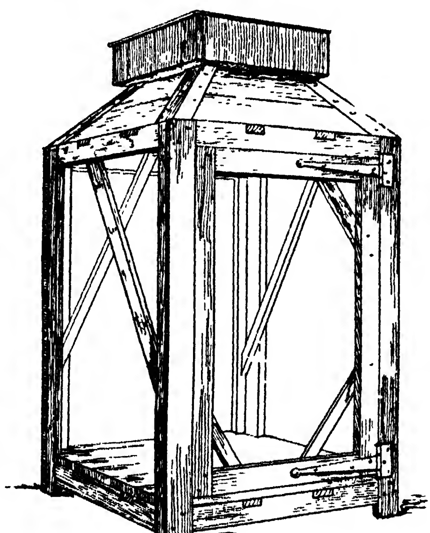
No 1



No 2

and bottom by a brace 1 ft. 6 in. long let flush into top of rails and nailed thereto with 2-in. nails.

The floor is formed with 6-in. x ¾-in. tongued and grooved boards nailed on top of rails with 2-in. nails.



No 3

The top is to be formed, as shown in drawing No. 3, of 6-in. x ¾-in. The sloping sides are supported on eight triangular pieces 1½ inch thick, well nailed to top of rails and stiffeners. In order to save the

labour of carefully mitreing the angles so as to keep the water out of the safe, it will be necessary to cover the joints with a strip of galvanized iron.

The door is constructed in the same manner as the sides, but with two short braces, as shown in drawing No. 3, to be hung on a pair of 12-in. T hinges and fitted with turn button or other fastener.

In order to catch the drip when door is opened, a small gutter made of light galvanized iron should be hung on galvanized iron staples to inside of top rail of front. It should be so hung that when the door is opened the gutter will swing forward sufficiently to catch any drips, and the door in closing should push gutter back.

A small gutter made of galvanized iron should be fixed with galvanized iron clouts to outside of bottom rails with a fall to the corner most convenient for running the water off.

The basin on top may be any watertight vessel, into which strands of wool are placed to syphon the water out on to the hessian.

All the drawings, for the sake of clearness, show the framework without any covering. All the framework is to be covered externally with hessian fixed to rails and uprights with copper tacks.

THE FRUIT TRADE OF VICTORIA:

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page* 671, *Vol.* X.)

By E. Meeking, Senior Inspector of Fruit.

PART III.—INTER-STATE TRADE.

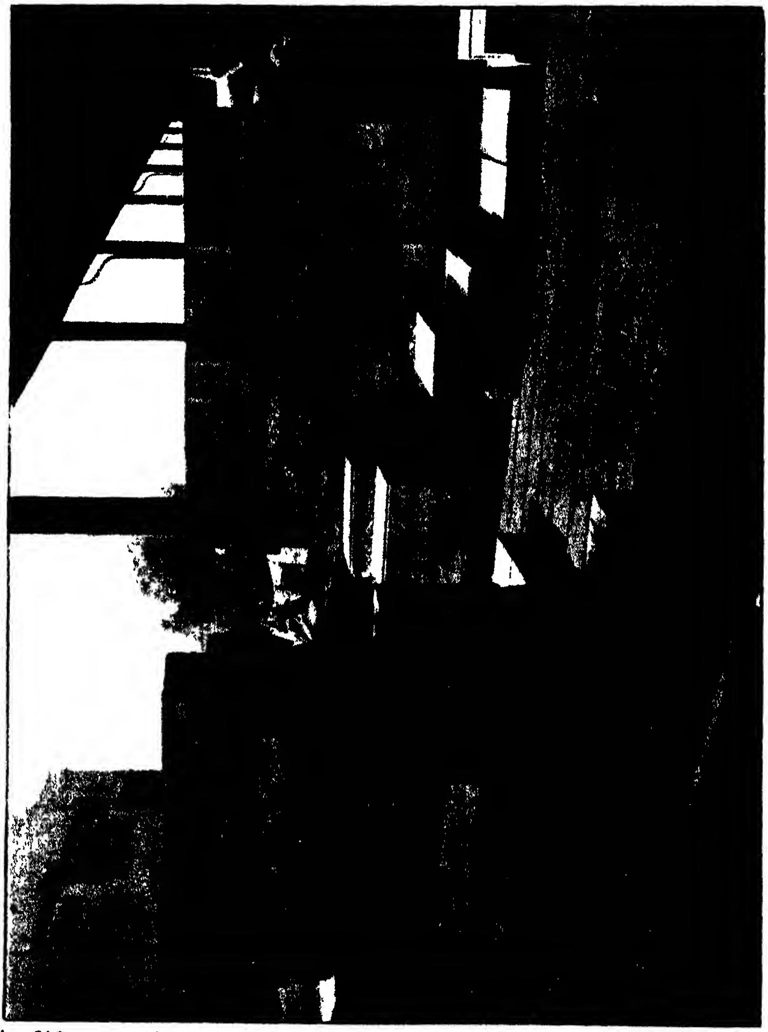
It would appear. from the reports of the proceedings of the Annual Conferences of Fruit-growers each year, that the importance of maintaining and further developing the Inter-State trade in fruit on modern lines is not apprehended as fully as its importance deserves. When it is considered that, as before stated, the export of fruits to other States of the Commonwealth in the year 1910-11 totalled 484,413 bushels, or 13.5 per cent. of the total fruits raised in Victoria during that year; and when it is realized that this quantity exceeded the quantity exported to all over-sea countries (including South Africa, the East, and New Zealand) by 196,116 bushels, it will be readily understood that the maintenance of the trade already established ana its development on profitable lines are essentially important to the fruit-growing industry of this State.

Regarding the kinds of fruits exported to other States, it is worthy of note that these consisted principally of apples, cherries, pears, and plums; the quantities of these in bushels being as follow:—Apples, 112,031; cherries, 25,114; pears, 282,351; plums, 53,165. Total, 472,661 bushels. This left a margin of only 11,752 bushels of all other kinds of fruits.

Our best customers in this trade are the two northern States of New South Wales and Queensland, as more than two-thirds of the total exported in the year under notice were forwarded to these two States.

Rail *versus* Water Transportation.

Owing principally to water transportation being cheaper than transportation by rail, the bulk of our fruits are consigned to other States by the various lines of Inter-State steamers which ply between Melbourne and other ports of the Commonwealth. The cost of water transportation is, under any circumstances, relatively cheaper than rail transportation; but, between Victoria and the northern States,



INSPECTED FRUIT AWAITING REMOVAL.

this difference is accentuated by the unfortunate break in rail gauge at Albury. This undoubtedly drives a considerable portion of the trade to the shipping companies; as the delay and extra handling of consignments at the border, combined with the added expense which this handling entails, introduces an element of risk into the business which the exporter usually does not care to accept. Rail transport is, therefore, chiefly availed of only when the exporter wishes to rapidly

transfer his fruits to the markets of the northern States during such times as extra good prices prevail, and when he wishes to reach these before a general rush of produce causes the prices to fall. This is to be regretted; as there is little doubt that, were the rail gauge uniform throughout, the traffic in fruit interchange by railway would be much augmented, for, under proper and up-to-date conditions, rail transportation possesses so many advantages over transportation by

FUMIGATING INTER-STATE FRUIT.

water that the extra cost of the former is more than counterbalanced. These advantages consist of rapid transit, and the estimation of the time almost to an hour when consignments will arrive on the intended markets. Owing to the perishable nature of most fruits, these advantages are of the utmost importance. However, in spite of the disadvantage of transfer at the border, it must be confessed that

fruits forwarded to the northern States by rail usually arrive in better condition than those shipped by water.

This is due to the fact that, in addition to the more rapid transfer which the rail confers, the shipping companies do not provide any compensating advantage by the adequate installation of refrigerator accommodation on the Inter-State steamers; so that if the small percentage of consignments which are shipped in the limited refrigerator space on these steamers is excluded, there is little doubt that the consignments sent by rail arrive in better average condition than those forwarded by steamer as ordinary cargo.

These facts, indeed, are quite realized by many of our leading fruit agents, who, notwithstanding the existing disabilities, prefer to transfer fruit consignments to other States by rail whenever such may be warranted.

BREAK IN INTER-STATE RAIL GAUGE A SERIOUS DRAWBACK.

The most serious aspect which the break of rail gauge between Victoria and New South Wales presents is the fact that as the populations of the northern States increase, and the markets for our fruits in these widen, the utilization of ice car service will be prevented, as the transfer of fruits at the border from one set of ice cars to another set would, especially during warm weather, cause such condensation and fluctuation of temperature in consignments as to render the use of this type of car worse than useless. If we are to be guided by the experiences gained on the North American Continent during the rapid and enormous development of the fruit industry there during recent years, the serious nature of this disability in the expansion of our trade with New South Wales and Queensland will be realized; for the pre-cooling of fruits prior to transport, the evolution of the refrigerator car, and its almost universal use in connexion with the transport of fruits to the various markets in America, may be reckoned as amongst the most important factors in the growth of the fruit trade in the United States and Canada.

NEED FOR BETTER METHODS OF TRANSPORTATION.

It is not only in connexion with land transportation that a dearth of up-to-date methods is manifest. The refrigerator accommodation on the Inter-State steamers is sadly behind the requirements of the trade. Only certain of the regular steamers are provided with refrigerator space at all, and even in these, the accommodation is so limited as to be of little practical utility to the trade as a whole.

It is not over-estimating the case to state that from 10 to 15 per cent. of consignments conveyed by Inter-State boats are lost before they reach the consumer through lack of cool storage accommodation during transit.

APPARENT ANOMALIES IN FREIGHTS.

What appears to be an anomaly, and one which would tend to act as a drawback to the development of the fruit export trade from Victoria to the other States, is the higher rates which are charged by the shipping companies on fruits shipped from Melbourne to many other

Australian ports than the return charges from those ports to Melbourne. This is shown by the list hereunder:—

INTER-STATE STEAM-SHIP FREIGHTS ON FRUITS.

Ordinary.

To Sydney, 10s. 6d. net from 10s. 6d. net	
To Brisbane, 22s. 6d. from 14s. 3d	Subject to 5 per cent. rebate.
To Maryborough, 29s. from 21s	
To Rockhampton, 30s. from 24s 9d	
To Mackay, 39s. from 27s 6d.	
To Bowen, 39s. from 27s. 6d.	
To Townsville Jetty, 36s. from 24s. 3d	
To Townsville. 39s. from 27s. 6d.	
To Ross Creek, 39s. from 27s. 6d.	
To Cairns, 54s from 33s	
To Cooktown, 60s 6d from 34s	
To Port Douglas, 60s 6d. from 34s.	
To Adelaide, 10s. 6d. net from 10s 6d net	
To Albany, 34s. 9d from 24s 9d	Subject to 5 per cent rebate.
From Fremantle, 34s. 9d from 24s 9d	
To Bunbury, 38s. 6d from 27s 6d	
To Geraldton, 46s. 3d from 33s.	

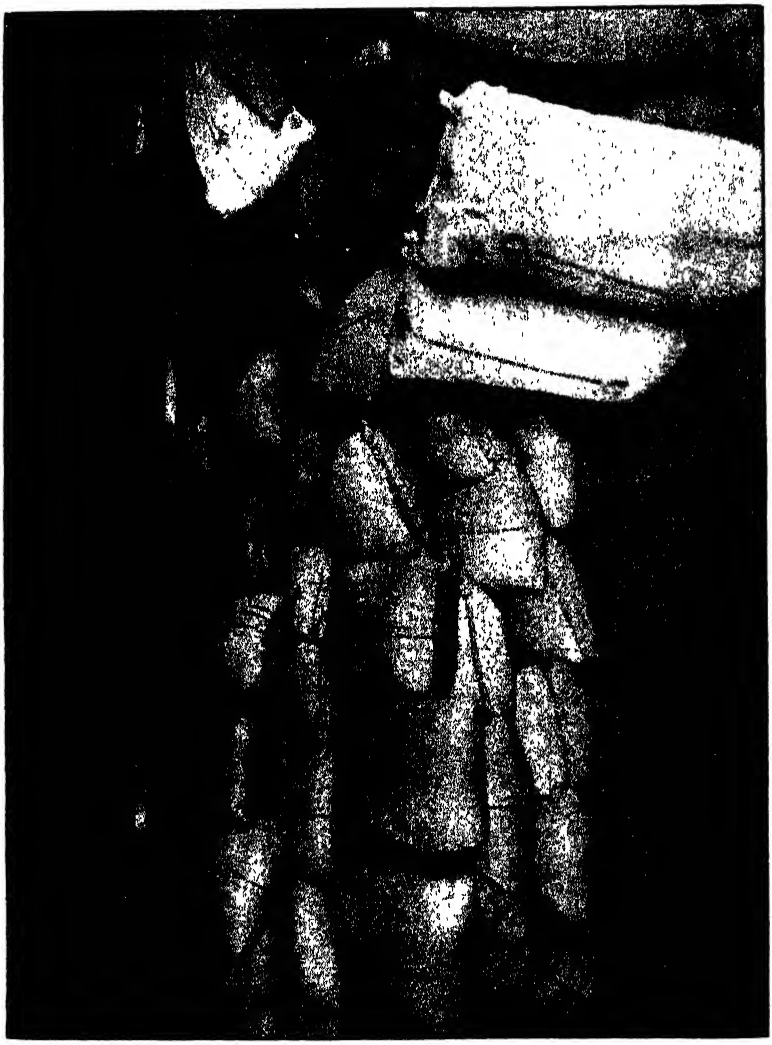
The above list shows the rate charged per ton measurement (23 cases per ton) on fruits carried as ordinary cargo. The rates charged

DELIVERING INTER-STATE FRUIT AT WHARF.

on fruits carried in refrigerator space are much higher than these, being from 10s. to 20s. per ton in excess.

The reason for granting preference in freight charges from other Australian ports to Melbourne seems hard to understand. It cannot be claimed that the concessions are wholly granted on the one hand to encourage an export trade from ports where such trade is small, or that granted to ports from which the trade is so extensive as to justify a reduced rate; as the average freight charges from Melbourne to most of the Inter-State ports is higher than the return charges from those ports to Melbourne, irrespective of the volume of trade in either direction.

For instance, although the exports from Albany, Fremantle, and other West Australian ports to Melbourne are practically *nil;* and the exports from Brisbane, Maryborough, and certain other Queensland to Melbourne exceed the exports from Melbourne to those ports, yet the freight charges to both the West Australian and Queensland ports are much higher than the freights from all those ports to Mel-



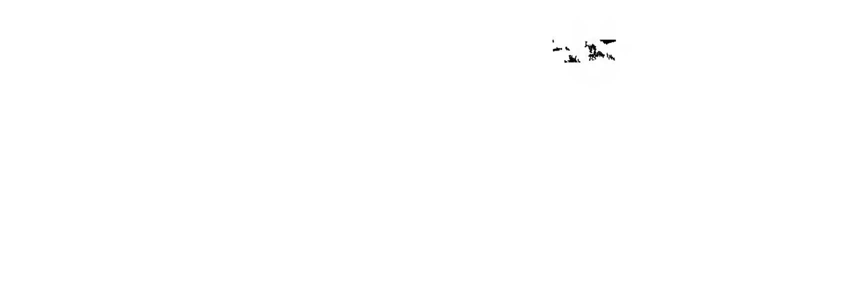
FUMIGATING MAIZE.

bourne. These anomalies in rates are matters which our shippers of fruits to Inter-State ports might inquire into with advantage.

INTER-STATE SHIPPING CHARGES APPARENTLY TOO HIGH.

Apart from the question of the anomalous rates as mentioned above, the freight charges imposed generally by the Inter-State shipping companies for the conveyance of fruit between the different ports

of the Commonwealth seem much too high. Notwithstanding this, the matter has not been given the attention on the part of growers and shippers which its importance deserves, although much discussion has arisen during recent years regarding the freight charges imposed on fruits shipped to the United Kingdom and Europe, and the opinion has been freely expressed in many quarters that these charges (which average 65s. per ton) are too high. This is probably true; but what should be said of the Inter-State charges, which would appear by comparison with those levied on fruits shipped



AMERICAN PACKING SHOWING CORRECT AND EXCESSIVE BULGE.

to the United Kingdom and Europe little short of extortionate? This is the case with the freight charges from Melbourne to all ports of the Commonwealth, but the charge on fruit consigned in refrigerator space from Melbourne to Sydney will suffice for an example. This charge is 21s. 6d. per ton, or nearly one-third the freight charged from Melbourne to London, although the distance from Melbourne to Sydney is, roughly, only one-fifteenth the distance from Melbourne to London.

(*To be continued.*)

MILKING MACHINES—

There is, perhaps, no machine in use on the farm about which such diversity of opinion exists as the milking machine. Some farmers consider it a capital invention, and a great labour-saver; others would not have one about the place. The fact seems to be with this machine that success depends in rather more than ordinary degree upon the care and skill of the operator. A recent issue of *Hoard's Dairyman* puts the matter concisely:—"The milking machine has passed the experimental stage. Better results can be obtained from it when properly worked than from a certain class of milkers. We know of herds that have been milked for several years with the milking machine, and the owners are well satisfied with results. The trouble has been, in some instances, that people without any mechanical ability have tried to operate the milking machine, and, lacking in persistency and ingenuity, have laid them aside with the feeling that they were not sufficiently perfected to do satisfactory work."

WHEAT AND ITS CULTIVATION.

Continued from page 707, Vol. X.

No. 9.—WHEAT IMPROVEMENT.

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

One of the most remarkable and interesting features of modern agriculture is the extraordinary activity displayed in the subject of plant improvement throughout the world.

This extraordinary activity is very largely due to the rediscovery of Mendel's work by De Vries, Tschermak, and Correns, the epoch-making work of De Vries on the mutation theory, and the stimulus given through the establishment of schools of genetics in the older universities of the world.

Practically every agricultural crop of importance has been subjected to a critical study during the last decade, with a view of determining the best lines on which specific and desirable improvements may be brought about.

Systematic plant-breeding is a comparatively modern development. The reason is not far to seek. From the dawn of civilization, man's attention has been occupied with the improvement of his animals rather than his crops. Indeed, improvement in plants was hardly possible until the sexuality of plants was discovered, and the necessity of pollen in seed formation became known and generally understood. The discovery of sexuality in plants was only made in 1691 by Camerarius, and nearly half-a-century elapsed before the structure of the flower was properly appreciated.

Thus, while systematic mating of plants could not have been practised for more than two centuries, the control of the breeding of animals has been undertaken by man for over 2,000 years.

Though the practice of plant-breeding is quite a modern development, the amount of data already collected is sufficient to indicate that enormous possibilities lie ahead of this line of work.

The great improvements wrought in our flocks and herds by careful, systematic breeding is apparent to the veriest novice. The development of the Booth and Bates' types of Shorthorn cattle, the American trotting horse, and the Australian type of Merino sheep may be taken by way of illustration. No one nowadays would express the least surprise if a breeder of dairy cattle attempted to breed a herd of stock giving milk of unusual richness in butter-fat. It is so common a phenomenon now that it ceases to cause wonder.

But to set out with the definite intention of breeding farm crops, with the object of improving them in certain specific qualities, is still considered unusual enough to occasion considerable surprise. The fundamental principles of breeding and inheritance, however, are the same, whether they are applied to animals or to plants. Is it not perfectly rational then to assume that profound changes may be wrought in the vegetable world by the application of those principles of breeding which have brought individual flocks and herds to the high pitch of excellence of the present day?

Let it be remembered that the plant-breeder has at least one immense advantage over the animal-breeder.

He can work with hundreds of thousands of individuals, and can afford to make his selections with the utmost rigour, and take the very fullest advantage of the individual variations of type, which, as will be seen later, are the basis of all future improvement.

The animal-breeder, for many reasons of which not the least is the expense incidental to breeding and feeding of large numbers, must, of necessity, confine his attention to comparatively few animals, and the probabilities of securing wide and valuable variations are thereby considerably lessened.

IMPORTANCE AND AIM OF WHEAT IMPROVEMENT.

According to the Commonwealth statistics for 1910-11, of the total area under crop, namely, 11,893,838 acres, no less than 75 per cent. represented wheat and wheaten hay. The wheat of the Commonwealth

VIEW OF STUD SELECTION AND CROSSBRED PLOTS, RUTHERGLEN EXPERIMENTAL FARM, 1912.

for 1910 amounted to over 95,000,000 bushels, and the cash value, at 3s. 4d. per bushel, equals nearly £16,000,000. During the past decade the enriching and improving of the soil has been the dominant note in our system of wheat-farming. Attention has been concentrated on the use of fertilizers, improved methods of tillage, and the adoption of rotation adapted to the climatic and soil conditions. These improved methods of grain-culture have placed the wheat industry of the State and of the Commonwealth in a very secure position. These important developments all aim at improving the soil conditions, or what might be termed the plant's environment, by bringing within the range of root action a plentiful supply of those elements essential for the welfare of the crop.

In the near future, however, there is reason to believe that greater attention will be directed to the improvement of the wheat-plant itself, and to the production of varieties adapted to specific conditions and

requirements. The possibilities ahead of such activities are obvious. If, by any process of plant improvement, the average yield of a given variety of wheat could be increased by only 1 bushel per acre, it would mean that the farmers of this State would reap £500,000 more each year, without a single cent extra being spent either in cultivating or manuring the land.

A quality of prime importance that should be developed to the full in Australian wheats is drought-resistance. The varieties of wheat brought with the pioneers from the Old Country were not drought-resisting in character. Accustomed for centuries to growing in relatively cool climates, with abundant rainfalls, these wheats had developed qualities which unfitted them for growing in the drier parts of Australia. Eighty-five per cent. of the wheat of Victoria is grown north of the Dividing Range, and a large portion of this is grown in relatively dry districts. If ever the drier parts of Australia lying beyond the present margin of cultivation are to be brought under the plough, the cultivation of drought-resisting varieties will be a fundamental pre-requisite. Varieties are needed in these areas which possess a short growing period, *i.e.,* rapidly-maturing wheats which will make the most of our short winters, and which produce a maximum of grain and a minimum of flag. Other properties of prime importance are the milling qualities of the grain, and the colour, strength, and gluten content of the flour. The present practice in Victoria is to sell all wheat on the basis of one grade, f.a.q. This practice obviously does not encourage a farmer either to grow grain of high quality or pay any special attention to the cleaning of the sample. The time is not far distant, however, when wheat will be sold on grade, just as is done with butter, cream, fruit, and other produce.

Before a wheat can be considered of high milling quality, it must be satisfactory in three respects—(1) colour, (2) gluten content, (3) strength.

The flour made from the wheat must be such as to make bread of snow-white colour, in order to satisfy the demands of the consumer. So long as this demand for snow-white colour continues, so long must both miller and baker consider the question of colour of great importance.

Incidentally, it might be mentioned that Victoria has always been able to produce wheats which, on milling, give a flour of excellent colour, and it is principally on this account that these wheats meet with such a ready sale on the English market. We cannot overlook the fact that, generally speaking, the varieties commonly grown are wanting in strength and gluten content. It may be that these deficiencies are a characteristic of the climate, and, if so, we might be inclined to infer that improvement in these respects is beyond the limit of possibility. While it is true that these important qualities are in a large measure dependent on the climate, there is every reason to believe that they may be developed in our wheats to a much more satisfactory degree than at present.

Convincing evidence of this may be seen in the case of Comeback, Bobs, and Cedar—varieties of exceedingly high strength—which have been bred and developed by the late Mr. Farrer under Australian conditions.

The great objection to these varieties is, however, that under ordinary farming conditions their yields are not satisfactory, so that, in spite of the enhanced prices which may be obtained for them, they are hardly as profitable to the farmer as the commoner but more prolific varieties. The interest of the farmer demands that the varieties of wheat grown by him should be prolific, rust resistant, and relatively drought resistant.

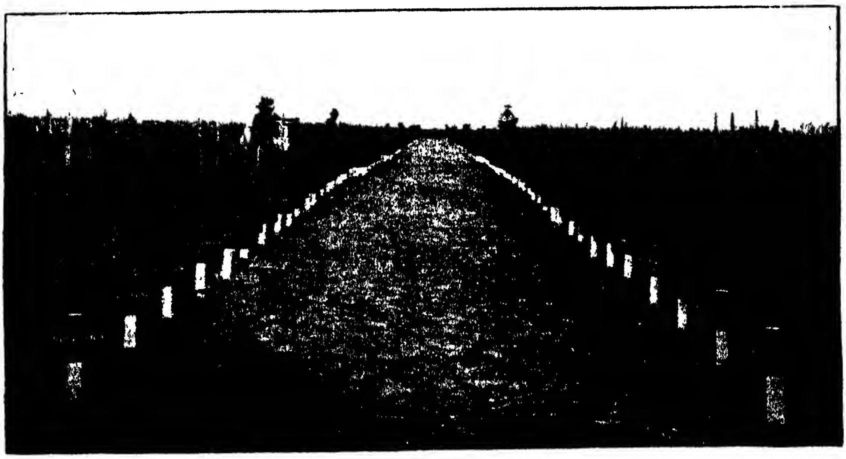
It is to the miller's interest that the varieties grown should give a good yield of flour of good colour.

It is to the baker's interest that the flour should be of high strength, so that he may make the maximum of loaves of bread per sack.

It is the wheat-breeder's task to produce a variety which will completely satisfy the farmer, the miller, and the baker.

WHEAT BREEDING IN OTHER COUNTRIES.

Before discussing the methods whereby these specific improvements may be made, it may be of interest to briefly review what is being done in other countries.



STUD SELECTION AND CROSSBRED PLOTS, LONGERENONG AGRICULTURAL COLLEGE, 1912.

Systematic breeding of wheat and other cereals has been practised for many years past in the United States, Canada, Germany, France, Sweden, Britain, and India.

A large number of agricultural experiment stations and colleges in the United States are at present engaged in breeding new varieties of wheat. The Minnesota station has originated numerous varieties, two of which have "yielded from 1 to 3 bushels more per acre than the varieties formerly grown."* Other stations, particularly Maryland, North Dakota, California, and Ohio, have done much valuable work in the production of new varieties and the improvement of existing types.

In Canada most of the breeding and selecting of wheat has been done in connexion with the Dominion Experiment Farm system on the central station at Ottawa. Dr. William Saunders (now

* Year-book of the Department of Agriculture 1908, p. 155.

Director of Experiment Farms) began the work of wheat improvement in Canada in 1888. Working on the Red Fife wheats, he succeeded in producing the cross-bred varieties—Stanley, Preston, Huron, Marquis, and Bishop—which are now widely grown throughout Canada.

In England, Biffen, of Cambridge, has done a large amount of work in wheat improvement. Biffen has paid special attention to the production of a variety of wheat combining the important qualities of (*a*) high yielding capacity of the English varieties; (*b*) the high strength characteristic of the Manitoba wheats; and (*c*) immunity from yellow rust (*Puccinia glumarum*). He claims to have achieved considerable success in this direction.

In Sweden, the wheat breeding is concentrated at Svälof under the direction of the Swedish Grain Society. This society has done a vast amount of good in introducing superior varieties of wheat in Swedish agriculture. No less than fifteen trained plant specialists are engaged in this work. Details of this institution will be discussed later.

In Germany, a large number of public and private institutions are engaged in the improvement of cereals and root crops. According to Hillman,* there are no less than 84 breeders engaged on the improvement of wheat, 46 of rye, 65 of barley, 53 of oats, and 44 of fodder and sugar-beets.

A considerable amount of work has been done in India towards the improvement of local wheats by selection and crossing. It is interesting to note that many Australian varieties have been tried by the Indian Government, in the hope that these would be of direct value under Indian conditions.

Among others, Purple Straw, White Tuscan, Frampton, and White Essex were tried at Lahore,† Lyallpur, and Hyderabad from 1893-1894 to 1900, but the results were not satisfactory. It is also interesting to note that in 1900, W. H. Moreland, the Director of Agriculture of the United Provinces, was deputed by the Government of India to visit Australia and study Farrer's methods.‡ As a result of his visit, a wheat-breeding station was established at Cawnpore in 1902 by the Indian Government. In addition, centres for wheat breeding were established at Pusa, Lyallpur, and Poona.

WHEAT BREEDING IN AUSTRALIA.

The outstanding feature in wheat-breeding work in Australia is the remarkable success achieved by that patient and retiring genius—the late William Farrer, of New South Wales—in every branch of wheat improvement.

A man who could set out clearly and comprehensively as Farrer,§ both the goal towards which he was striving in his work of wheat improvement, and the methods whereby he hoped to reach that goal, and in less than a decade flood the market with varieties like Federation—the most prolific and popular farmer's wheat in the Commonwealth; Bobs, and Comeback—of unsurpassed milling excellence; Florence and Genoa—bunt-resisting varieties; and a host of others.

* P. Hillman, Arb. Deut. Landw. Gesell. (1910) No. 168.
† Reports of the Government Horticultural Gardens, Lahore, and the Lyallpur Farm, 1893-4 *et seq.*
‡ Moreland Agricultural Ledger, India (1901).
§ Farrer: The making and improvement of new varieties of wheat for Australian conditions. *Agricultural Gazette* (N.S.W.), February, 1898.

enjoying widespread popularity, such as Bunyip, Thew, Bayah, Warren, Genoa, Firbank, Cleveland, Cedar, Jonathan, etc., must have possessed in an unusual degree the insight of genius. It is no exaggeration to say that Farrer has added millions sterling to the national exchequer by the creation of Federation wheat. Dr. Cherry estimates the cash value of Farrer's work to Victoria alone during the 1909 season at £250,000.* Since that estimate was framed, the area sown with this popular variety in Victoria has greatly increased, and the benefits have become commensurately greater.

Farrer's work was continued by Mr. G. L. Sutton—late Wheat Experimentalist of New South Wales—who did a great deal to popularize the Farrer varieties amongst farmers.

In this State, Mr. H. Pye, the present Principal of Dookie Agricultural College, has been the most prominent investigator of the problems connected with the improvement of wheat varieties. For many years he collaborated with Farrer in the testing of new varieties, and the independent work he has done has resulted in the production of a number of crosses possessing improved qualities, which are now undergoing the process of fixing and testing on a commercial scale. The work of producing new varieties of value is necessarily slow and tedious, and the results of Mr. Pye's long and patient work will doubtless be of immense benefit to wheat-growers.

In South Australia, the improvement of varieties by selection and cross-breeding is carried out at the Parafield Wheat Research Station and at the Roseworthy College. The demand for improved and selected cereals from both these centres has for many years past greatly exceeded the supply.

Many of the varieties grown in the wheat areas of the Commonwealth were originated by private farmers. With one or two exceptions, these varieties were obtained by selection from the ordinary crop. Among many of the varieties that might be mentioned are Dart's Imperial, Marshall's No. 3, Correll's No. 7, King's Early, Yandilla King, Steinwedel, Petatz Surprise, Carmichael's Eclipse, and Huguenot. In most cases these varieties originated from a single plant growing in the ordinary field crop. The outstanding qualities of these plants arrested the attention of the originator, who harvested them separately, and multiplied the seed for distribution.

How Improved Varieties May be Obtained.

There are two general methods by which improved and new varieties may be obtained, namely, by—

1. Selection.
2. Cross-breeding.

We will consider each of these in some detail.

It must be borne in mind that in a young country like Australia many varieties of value may possibly be obtained from the older agricultural countries of the world, where wheat is grown under conditions not unlike our own.

Some preliminary acclimatization is usually necessary in these cases. How far such introductions are likely to be of value to us will be considered later.

* *Journal of Agriculture*, Victoria, 1909.

SELECTION.

Vilmorin, a renowned authority on plant breeding, states that "selection is the surest and most powerful instrument man possesses for the modification of living organisms."* Reduced to simplest terms, it consists merely in the choice of the best individuals for the propagation of seed, and it is by means of selection exercised through centuries that our cultivated plants have reached their present standard of excellence. The obvious effects of selection may perhaps be seen to best advantage in the animal world. It was by patient, systematic selection, exercised over a long period of years, that the famous Booth and Bates types of Shorthorn cattle were developed. What we term pedigreed stock in Merinoes, Clydesdales, Jerseys, &c., have been produced by a slow, painstaking process of selecting the very best animals in the herd, accompanied by a vigorous exclusion of the culls. While the vast majority of farmers are well aware of the beneficent effects of selection in the animal world, they appear to be totally oblivious of the fact that selection can be equally effective when applied to the plant world.

The term "selection," as commonly used, covers a general, as well as a specific, idea. In its general sense, selection is practised by every good farmer when he chooses varieties of wheat that are best suited to his soil and climatic conditions, reserves the best portion of his crop for seed purposes, and takes good care to grade his seed well. No well-informed stock breeder would think of selecting as his parent stock any other than the best animals he can secure with the means at his disposal. Nor should any wheat farmer be satisfied with anything but the best of his crop for seed purposes. He should take the greatest pains to get, first, the right variety of wheat; second, well-developed seed; and third, the seed should be secured from the most vigorous plants. The latter point is very important.

With regard to the choice of varieties, it may be pointed out that the difference in yield between two varieties of wheat grown on the same farm, under precisely similar soil and climatic conditions, is frequently sufficient to pay the rent and interest on the land on which the crop was grown. This has been demonstrated time and again in departmental experimental plots and on private farms.

Carefully-conducted experiments in various parts of the world demonstrate that it pays a farmer to give careful attention to the selection of his seed.

In Canada, Zavitz† states that during twelve years' work at the Ontario Agricultural College, large, well-developed grain of winter varieties of wheat averaged 46.9 bushels per acre, as against 39.1 bushels from small shrunken seed, and with spring wheat the average yield from the well-developed, plump seed was 21.7 bushels, as against 16.7 of the small seed.

In Britain, the University College of Wales‡ reports that nearly double the yield was obtained from plump grain as against small grain.

Desprez, in France,§ after experimenting with a large number of varieties of wheat, draws the conclusion that the results are markedly in favour of large seed.

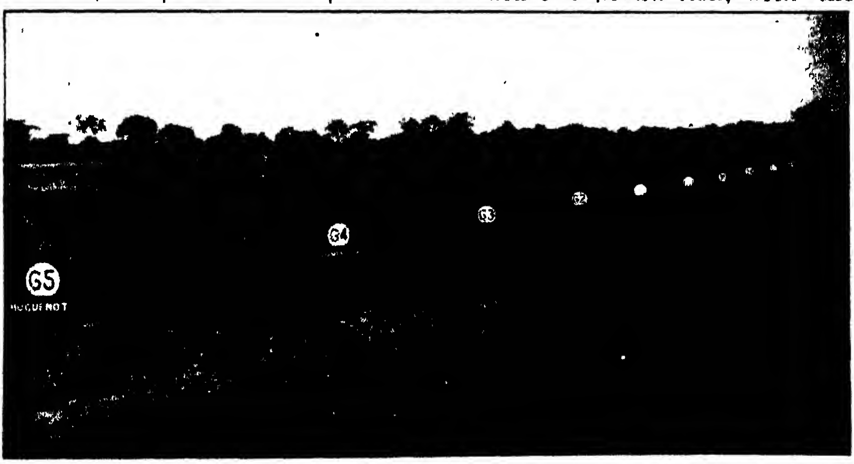
* Vilmorin Exper. Station Record XI., p. 19.
† Zavitz: *Journal of the Board of Agriculture*, June 1910, p. 35.
‡ Report of University College of Wales, 1899, p. 68-70.
§ Jour Agri. Prat. (1897).

Cobb (N.S.W.),* after an exhaustive comparison of seed wheat from 24 varieties, states that the increased yield obtained from well-graded seed is sufficient to justify the installation of first class cleaning machinery.

The results obtained at some of the American Experimental Stations are conflicting, but, wherever care was taken in the selection of seed, considerable increases in yield resulted. This was the case at Kansas, Nebraska, North Dakota, and Indiana experimental stations, whilst at Pennsylvania and Ohio no marked increases resulted.

From these various experiments it may be safely concluded that the best results will be obtained by the selection of well-developed, plump seed, from plants of strong vitality.

The term selection is generally more restricted in meaning. It has now acquired a technical significance, and implies the systematic choosing of specific wheat-plants for future reproduction, with the



SELECTION PLOTS IN EARLY SPRING, RUTHERGLEN EXPERIMENTAL FARM, 1912.

object of bringing about an amelioration of type. It recognises that there are endless variations of type in an ordinary wheat crop—that there are grades of quality in wheat just as there are grades of quality in fruit and butter.

Selection seeks to isolate those types of plant which approximate most nearly to the ideal, and to systematically choose from the produce of these types the variations which are likely to be of material value.

This is the manner in which most of the improvements in our field crops have resulted.

Unconscious and Conscious Selection.

Of course, many of the modifications effected in plants, through long years of cultivation are the result of unconscious improvement. This is exemplified by the development of the cabbage, cauliflower, and kohl-rabi from the woody perennial plant (*Brassica oleraceæ Linn.*), which is a native of Southern Europe. The cabbage is a modification of the leaf, the cauliflower of the inflorescence, and kohl-rabi of the stem of this plant, and their origin is due to long-continued selection of

* Cobb: *Agricultural Gazette*, New South Wales, 1903.

variations which were considered desirable, and not because the gardener consciously attempted to evolve these specific forms.

On the other hand, many instances might be quoted in which improvement has been effected by systematic breeding.

Perhaps the most striking case is that illustrated by the development of the sugar content in beets. By a process of careful, repeated, and systematic selection of individual plants of high sugar content, combined with the repeated testing of the hereditary powers of each individual plant, the common beet, containing from 6-7 per cent. of sugar, has been developed into the sugar beet, containing from 20-25 per cent. of sugar.

The value of this improvement must be obvious. It has enabled the beet-sugar industry in Europe and America to more than hold its own against the cane sugar produced by black labour in the Tropics.

A remarkable case of selection is referred to in De Vries'* work. In 1886, De Vries found at Loosdrecht a plant of clover bearing a few leaves with four and five leaflets. He commenced some experiments to fix this type of clover. By continuous cultivation and selection, he ultimately (1892) secured plants in which four and five leaflets on each leaf were common, and, strangely enough, for the first time several leaves appeared with six and seven leaflets.

It is very probable that no clover plant in the world ever possessed six or seven leaflets until De Vries commenced these experiments.

HISTORY OF WHEAT IMPROVEMENT BY SELECTION.

The idea of improving cereals by selection is of comparatively recent origin. The most notable of the early wheat-breeders were Le Couteur, of Jersey; Shireff, of Haddington; and Hallet, of Brighton.

Le Couteur, nearly a century ago, observed that an ordinary field of wheat appeared to be extremely variable, and concluded that some of the various types found in the growing crop would yield better than others. He isolated 23 distinct types, and grew them separately, and was successful in introducing several new varieties into general cultivation. One of these is still grown under the name of Talavera.

A Scottish agriculturist—Patrick Shireff—developed the celebrated Hopetown oats in 1832, and placed on the market four distinct varieties of wheat, all of which were extensively grown in his time. His method of procedure was to walk through his wheat fields at harvest-time, and mark any plants which stood out prominently from the surrounding plants. He isolated these plants, sowed them separately, subjected them to severe tests, and sold the seed of the most promising types.

It is very interesting to note that neither of these breeders adopted the principle of *repeated* selection. They simply isolated individual plants of promising appearance, and multiplied the seed of these types as rapidly as possible. There was but one initial selection, followed by rapid multiplication of the progeny. On this fundamental point they differed widely from Major Hallet, who began his work of selection in 1857. His method of selection was derived from his previous experience of breeding Shorthorn cattle.

* De Vries: "The Mutation Theory," Vol II., p. 36 (1910).

He first introduced the principle of repeated selection. His method was to select each year the best grain from the best ear of the best plant he could find in his wheat-field, and to repeat this process for a number of generations. On 18th June, 1862, he inserted a full-page advertisement in the *Times*, describing his methods of breeding wheats. In this advertisement he states that his "pedigree wheat was bred upon the same principle of *repeated* selection which has produced our pure races of animals."

During his first five years' work, the length of the head was doubled, the number of grains in the head trebled, and the tillering capacity was increased fivefold.

The improvements effected were, in a measure, artificial, inasmuch as he grew his selected plants on the very best and richest garden soil. Nevertheless, his strains were a success, and greatly improved the harvests of his generation.

The same principle of repeated selection has since been very largely practised in Germany, and has been very successful. Rimpau, in particular, has applied this principle of gradual improvement by continuous selection to rye, and succeeded in developing the famous Schlanstedt rye, which is now grown throughout France and Germany.

Another interesting principle in wheat breeding has been advocated by W. M. Hays, formerly of the Experiment Station, Minnesota. Hays adopted what is known as the "centgener" method of judging the efficacy of a given selection. He judges the value of a plant, not by its appearances, for these may mislead the observer, but by its performances in a "centgener" plot—by the average yield of 100 typical plants. His method is to isolate promising types of plants, and test their hereditary power by measuring the yielding capacity of 100 typical plants derived from each selection.

Finally, it is necessary to consider briefly the method of selection adopted at the famous Swedish Experiment Station at Svälof, Sweden, It may be explained that this station owes its origin to a small co-operative village company, formed in 1886 by private farmers for the production of improved seed wheat, oats, and barley, and the testing of new and foreign varieties of grain.

By means of exhibitions of pure seeds and numerous inspections of the experiment fields where the new varieties were grown side by side with the common Swedish varieties, the Swedish farmers soon became convinced of the financial advantages accruing from the sowing of improved seed. The company soon prospered.

Another society was organized at Orebro on similar lines to that of the Svälof company, but the two amalgamated, and formed the Seed Grain Society for Sweden. It became affiliated with a number of agricultural societies throughout Sweden, and received subsidies from them, as well as an annual grant from the Swedish Government.

The combination of the experimental and commercial sides of the undertaking became very inconvenient, and in 1891 a separate company was formed for the sale of the improved grains, under the name of the General Seed Grain Trading Company of Sweden. The Society now conducts all the experimental work, and produces the new varieties, while the General Trading Company distributes the grain of the ameliorated varieties to the farmers throughout Sweden.

Mr. R. B. Greig,* one of the members of the Scotch Commission who visited Australia just two years ago, gives a most interesting account of a visit to this remarkable institution

He says: " The work at Svälof is based on two discoveries—first that among the farm crops there exist an indefinite number of elementary species which breed true; and secondly, that superior individuals among these species can be quickly recognised by certain morphological characters. The first discovery was almost an accident; the second was the result of painstaking and minute investigation, assisted by an elaborate system of record keeping.

The Swedish Society for the Improvement of Grain was founded in 1886 by land-owners interested in agriculture, its object being to produce, by means of systematic selection, new varieties of farm crops yielding returns both larger and of better quality.

VIEW OF CROSSBRED PLOTS, RUTHERGLEN EXPERIMENTAL FARM, IN EARLY SPRING, 1912.

At first it was handicapped by inadequate funds and inferior buildings, but some years ago fine laboratories and other buildings were erected at a cost of 80,000 kroner, or £16,000, and the present annual income is between £4,000 and £5,000, made up as follows:—

Government subsidy	£2,200
Agricultural societies	1,100
The Swedish Seed Co.	275
Members of the society	550
Sale of produce	275
	£4,400

By a comprehensive series of trials, the principle was firmly established that unit of selection is the single ear or head. Further investi-

* Vide *Journal*, Board of Agriculture, London, August, 1910, p. 280.

gation brought out the fact that in an ordinary field of oats, wheat, or barley there were dozens of different types, most of which bred true. The next step was to discover the superior types, or those specially adapted for special conditions. It has been demonstrated that certain characters of apparently negligible importance are actually trustworthy indicators of the productive power of an individual and of its quality. This principle of correlation or association of characters has been found applicable to all farm crops, and while it sheds a brilliant light to guide the improvement of crops, and provides a short cut to success, it effectively bars any but the trained specialist from the speedy recognition of new varieties by selection."

It is now accepted as a principle that the improved and selected seed produced at Svälof should be grown in each of the climatically different districts of the country before the seed is distributed to farmers. Hence, branch stations have now been established at Ultuna and Alnarp, in addition to a number of smaller experimental centres in other districts, to enable the staff to ascertain the agricultural value of the new varieties under different conditions of soil and climate.

Basis of Selection.

It must be apparent from what has already been said that the possibility of improvement by selection rests on individual variation. There are no two plants or no two animals absolutely alike. To the man in the street each member of a large flock of merino sheep seems precisely the same as each other member of the flock.

To the shepherd or enthusiastic stock-breeder, however, each sheep possesses certain marks, peculiarities, and attributes which distinguish it from every other sheep in the flock. Plants likewise are variable, and Nature is always moulding the individual to fit some chink in its environment. Precisely the same difference may be detected by the skilled plant-breeder among a group of apparently identical wheat plants.

Cause of Variations.—The exact cause of these individual variations is not definitely known. Changes of soil, climate, methods of cultivation, changes in the food supply, and the struggle for existence are admitted to be important factors in inducing the variations. A prolific cause of variation is the "splitting of type" brought about by cross-breeding. This will be discussed in detail later.

Origin of Species.

Usually the variations from plant to plant are only small. Occasionally, however, considerable variations appear without any apparent reason, and these variations are more or less stable in character, and reproduce true to type. These are what De Vries calls mutations.

Before considering how new or improved varieties may be produced by man, it is interesting to briefly note in passing how species and varieties originate under natural conditions. According to Darwin,* species and varieties originate by what he calls *natural selection.*

He showed that the individuals of a species differ from one another to a slight extent, and that many of these differences increased or decreased their chances of survival. If all the seeds produced in a

* Darwin: "Origin of Species" (1859).

year by a given species were to germinate, there would be far too many plants to reach maturity. A fierce struggle for existence, therefore, results between the individuals of the species, and the fittest survive and the unfit perish. If the individual members of a species were all identical we could only ascribe to blind chance the fact that some survive whilst others perish. But they are not alike. Some plants are hardier and stronger than others. Some have a well developed root system which enables them to get nourishment where others fail. The slightest difference among plants may mean the difference between life and death, and it is this fact which enables Nature to continue her selection. The weaker individuals are forced to the wall in the struggle for existence, whilst the stronger survive. As Darwin says, "Those plants, in the long run, survive which are best able to adapt themselves to their environment." In other words, those individuals survive which vary in such a way as to give them some advantage over their less fortunate neighbours. As a result of this struggle, the mean of the species would be changed to some slight degree. If the variation is continuous, more and more change would take place; the small variations would be cumulative, and ultimately a new species would be produced.

The mutation theory controverts the older doctrine that variations may be augmented by selection until the differences become morphologically great, and until they become fixed and able to reproduce themselves.

According to De Vries,* new species and varieties originate by sudden changes—mutations, or sports, as he calls them.

According to this view, species are not slowly and gradually changed into new forms, but new and distinct types arise suddenly from the parent form. The variety, as a whole, continues unchanged, but produces from time to time aberrant individuals or mutations, which breed true to type, and are the real sources of all progress.

De Vries† bases his theory on the peculiarities of certain seedlings of the Evening Primrose (*Oenothera Lamarckiana*) which he found growing wild at Hilvershun, in Holland; and the large body of evidence which he has brought forward has done much to convince biologists that discontinuous variation was far more common than was formerly supposed. He emphasizes the fact that variations are of two kinds. (1) Small *individual variations* that do not reproduce or "come true," and are therefore assumed to be of no permanent effect in the evolution of the type. (2) *Mutations* or *sports* (heritable variations) which breed true to type, and which represent the starting point of new species.

In a word, the difference between variations and mutations is one of definition—the mutations breed true, the others do not.

The mutation theory does not deny the importance of selection as a means of improving agricultural plants, for, even if a mutation does appear, it may still be improved in its lesser features by careful and repeated selection.

METHODS OF SELECTION.

There are two general methods of selection adopted by plant-breeders—*mass* selection and *individual* selection.

* De Vries: "Die Mutations Theorie" Lepzic (1901).
† De Vries: "The Mutation Theory," Vol. I. p. 217 (1910).

Mass selection consists of the continuous and repeated selection of a number of the best grains, ears, or plants. It is based on Darwin's conception of the origin of species, and it is supposed that by the repeated selection of a number of élite plants each year, the race, as a whole, will be gradually improved.

De Vries denies that any permanent improvement can result from mass selection.

Fruwirth, on the other hand, affirms that mass selection does result in permanent improvement.

The effect of mass selection, as applied to oats, barley, and potatoes, has been strikingly demonstrated by Professor Zavitz at Ontario.* The following table summarizes the results of sixteen years' continuous mass selection on these crops:—

TABLE I.

AVERAGE YIELD in four year periods in bushels per acre of oats, barley, and potatoes, showing the effect of mass selection on self-fertilized and on vegetatively produced crops.

Crops	1890-93.	1894-97	1898-1901.	1901-05.
	Bush.	Bush.	Bush.	Bush.
1. Oats—Average for 8 varieties ..	74	79	83	100
2. Barley—Average for 8 varieties	50	54	63	63
3. Potatoes—Average for 8 varieties	120	216	218	249

Mass selection is most effective when the individual plant is made the unit of selection, and not the individual ear or the individual grain, for it frequently happens that large grains and large ears of wheat are found on relatively poor plants.

Mass selection thus practised tends towards improvement of the type by propagating from the best plants and excluding all the rest. It may, of course, happen that some of the selections thus made are superior because they have been grown under favorable environment. They may, for example, have received an extra amount of superphosphate through the irregular working of the drill, or they may have been favoured with more space to develop than the majority of plants in the crop. However, the repeated and rigorous selection of the best plants would gradually confine the choice to what might be termed the permanently superior plants, and the general character of the crop would gradually improve in the desired direction.

Mass selection has been practised with great success at the German experiment stations, and by such breeders as Rimpau, Drechsler, and Mokry. There are several different ways in which this method of selection may be applied. Whatever method is adopted must obviously involve as little labour as possible, and take up a minimum of time. To be completely effective, the selection must be continuous and uninterrupted, *i.e.*, the selection must be kept up year after year to counteract any tendency on the part of the wheat to degenerate.

A method which has the merit of being continuous and of requiring a small amount of labour is the following:—

A field of the variety which it is desired to improve by mass selection is carefully inspected at harvest-time, and sufficient

* Report, Ontario Agricultural College, 1905.

of the best-developed heads from robust, well-developed, prolific plants is selected to yield, on hand-threshing, about 5 lbs. of graded grain. This seed may be sown at seed-time, say in 1913, in one strip of the drill, on approximately one-tenth of an acre, as a " stud " plot. At harvest-time a similar process of selection of the best heads from the strongest plants in the " stud " plot is carried out, and the produce of the selection is reserved to form the " stud " plot of 1914. The balance of the " stud " plot of 1913 is harvested and sown as the " seed " plot of 1914 on an area of approximately 2 acres. In 1914 the process is repeated. The best selected heads of the 1914 stud plot become the stud plot for 1915, and the balance of the stud plot becomes the " seed " plot of 1915. The 1914 seed plot of 2 acres is harvested and sown on, say, 30-40 acres as a " bulk " plot for 1915, from which seed for the whole farm is obtained. Thus, after three years, the selection becomes automatic.

IMPROVED SELECTED OATS PLOTS, RUTHERGLEN EXPERIMENTAL FARM, 1912.

The small stud plot has been selected for three years, and represents the " élite " plants of a race which is gradually approaching a pedigreed character.

The full effects of the process would not be felt for at least three years—the time taken for the " stud " plot to become the " bulk " plot.

The method could be made more systematic by making the unit plot a single row of specially-selected plants, and rigorously selecting each season the very best plants of each row.

INDIVIDUAL SELECTION.

When the individual plant or ear is made the starting point, we have what is known as individual selection.

In this case the selection commences with a number of superior plants of a given variety, and the seeds from each plant or ear are separately planted, and kept under continual observation. This enables a strict comparison to be made of the progeny of each selection, so that in a few years the best strain in the original selections may be determined and multiplied for future use.

Nillson, at Svalöf, after subjecting the older methods of mass selection to a critical examination, decided to adopt the method of single-plant selection used by Shireff and Le Couteur, and has achieved a considerable amount of success. The method of procedure has already been described. As a principle, it is based on De Vries' conception of the origin of species, and it assumes that repeated selection is unnecessary.

Another example of individual selection is afforded by the method introduced by Willet M. Hays, of the United States Department of Agriculture. His method consists in isolating the most promising

SELECTED SEED PLOTS UNDERGOING TRIAL, RUTHERGLEN EXPERIMENTAL FARM, 1912.

types of plants in a crop, and of testing the efficacy of the selection by comparing the prolificacy of 100 plants derived from each of the strains so isolated.

For this purpose the produce from individual plants are sown in "centgener" plots. One hundred and forty-four seeds of each selection are sown in a square, with twelve seeds along each side. At harvest-time the outside border row is removed, and the remaining 100 plants are harvested, and the total produce obtained is taken as a measure of the prolificacy of a given strain.

Hays made a close study of variation in wheat, and found that those characters such as yield, which can be expressed in numbers, follow what is known as Quetelet's Law of Variability.

A simple illustration of Quetelet's law may be obtained by comparing the measurement of the height of 1,000 men of the same nationality. If 1,000 men be selected at random and arranged in a row in order of height, it will be found—

(*a*) the man in the middle of the line represents the average height of all men;

(b) a line drawn over their heads will diverge only very slightly from the horizontal throughout its entire length, falling gradually towards the end where the smaller men are placed;

(c) the line will rapidly curve upward near the upper end of the line where the tall men are placed, and will curve rapidly downward at the lower end where the shorter men are standing.

Hays* points out that if the individual yields of a large number of wheat plants of any given variety are arranged in order, a precisely similar curve may be obtained to that illustrated above. The great majority of the plants give only an average yield, a few give a very poor yield, and a few give an exceedingly high yield.

These latter are the plants which he uses for his future selections.

Hays states that in "each one thousand plants of wheat there are a few phenomenal yielders, and the method of single seed planting makes it practicable to secure these exceptional plants, and from these new varieties can be made."

Working on Fife and Blue stem varieties of wheat, which were largely grown in Minnesota, he succeeded in producing improved strains which gave yields of 15-20 per cent. more than the original types, and which have largely displaced them from general cultivation. Thus Minnesota 169 wheat was bred by a process of selection from a Bluestem variety commonly grown in Minnesota. During four consecutive years it averaged in field trials 4.9 bushels more than the parent type. In 1902 it was distributed in 4-bushel lots to 375 farmers, and reports showed that its average yield in 1903 was 21.5 bushels, as compared with 18.2 bushels average for the common varieties, *i.e.*, an increase of 3.3 bushels, or 18 per cent. Hays judges the efficacy of a given selection, not by qualitative differences, but by the quantitative factor—namely, the average yield of the progeny of each individual selection. This principle gives a far more satisfactory basis for work than the judging of a plant by its mere external characteristics, more especially when the end sought is an increase in prolificacy of a given variety rather than an improvement in some specific quality, such as milling excellence or rust resistance. It is therefore of great practical importance for those who are desirous of effecting improvements in prolificacy of our standard varieties of wheat.

Of course, in attempting an improvement in a given strain of wheat by any of the methods described above, care must be taken to avoid choosing those plants which excel their neighbours through merely accidentally favorable circumstances.

Irregular distributions of manure, variations in quality of the soil, and irregular seeding obviously lead to irregularities in the appearance of the individual plants, and considerable judgment is required on the part of the operator to decide whether the outstanding plants in a given crop really excel on account of individual excellencies or because they have been specially and accidentally favoured in the struggle for existence.

* Bulletin 62, Minnesota Experiment Station, U.S.A.

PLANT-BREEDING SOCIETIES.

There are a number of societies established in other parts of the world for the development and control of plant breeding. We are quite accustomed in this country to societies for controlling the breeding and registering the pedigrees of the various breeds of cattle, horses, sheep, and pigs, but there are no such associations in existence for the exercise of a similar control over plant breeding. The Ohio Plant Breeders Association may be regarded as typical of many associations which have been established for this latter work. According to the articles of constitution: "The purposes of this Association shall be to encourage the improvement of plants and provide for an official record for breeders who are giving special attention to this work." The establishment of these societies and the extensive support already given them serve to indicate how important plant improvement is regarded in those countries where agricultural practice has become highly specialized.

INTRODUCTION OF NEW WHEATS.

In a comparatively young agricultural country like Australia, the introduction of foreign varieties grown under conditions of climate not unlike our own is likely to lead to the acquisition of some useful varieties. In the first year of their growth the yields of foreign varieties grown under Australian conditions are invariably unsatisfactory and disappointing. They very rarely approach our local

FLOWER OF WHEAT (MAGNIFIED).

wheats either in prolificacy or general utility. It must be borne in mind, however, that what are termed our local wheats have been brought in the first instance from foreign shores, and that by prolonged cultivation under Australian conditions they gradually became adapted to their new environment.

This process is termed acclimatisation, and invariably takes some years. Before judgment can be finally pronounced, therefore, on the merits of any newly introduced varieties of wheat it is necessary to grow them for a number of years so that they may be given an

opportunity of adjusting themselves to local conditions. This is a universal experience. It always occurs wherever varieties of wheat are transferred to an environment totally unlike that in which they were produced. The process of acclimatisation may be hastened by artificial selection, *i.e.*, to sow the introduced seeds singly, and to propagate only from those plants which prove to be most healthy and to have thriven best under the new conditions.

Noteworthy instances of the rapidity of acclimatisation when thus assisted may be seen from experience at the Parafield Wheat Station, South Australia. A number of Canadian and American wheats were introduced six years ago, and grown in small test plots. At first the results were extremely disappointing, but latterly several of the varieties have given promise of excellent results and are finding their way into general cultivation.

Though it is probable that the introduction of new varieties from foreign climes may be of some direct value, there can be hardly any doubt that many newly introduced varieties will prove of great indirect value in the improvement of our local wheats. Thus in imparting such important qualities as the ability to *hold the grain, rust resistance, earliness of maturity, milling quality,* certain foreign wheats are likely to be of the greatest service.

By crossing varieties possessing these attributes with our local prolific types, new varieties may be produced which combine the prolificacy of the local type with the specific excellence of the introduced type.

Ilustrations of this may be seen in the cross-bred plots at Rutherglen and Longerenong this season, where crosses of early maturing short-strawed Indian wheats with Federation have resulted in the production of new varieties which are at the same time considerably earlier than Federation and at least as prolific.

Again, several improved Minnesota varieties have proved themselves singularly free from rust for several years past, though most of the local varieties have been badly affected. The drawback to these varieties has hitherto been their somewhat late maturity. Crosses made between early maturing wheats like Bunyip and Gluyas with these late maturing varieties have resulted in the production of new types which combine early maturity and high rust resisting powers.

The introduction and continued testing of foreign wheats, therefore, must be looked upon as an important part of the work of wheat improvement in a young country like Australia, because some of the new introductions may on acclimatisation prove to be of considerable direct value; and because these foreign wheats often possess certain specific qualities, highly developed, which enable them to be used with advantage in improving our own types by cross-breeding.

CROSS-BREEDING.

The second method of improving and creating new types of wheats is that of cross-breeding. The discussion of the aim, methods, and the principles governing the work will, however, be considered in the next article.

(To be continued.)

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition: April 15 to Nov. 14.	Nov. 15 to Dec. 14.	Total to Date (8 months).	Position in Competition.
40	White Leghorns ..	S. Brown	897	141	1,038	1
28	" ..	F. G. Eagleton ..	855	133	988	2
47	" ..	J. E. Bradley ..	846	134	980	3
23	"	W. McLister ..	853	123	976	4
31	" ..	Geo. Edwards .	846	128	974	5
20	" .	E. Waldon ..	832	137	969	6
9	" ..	J Spotswood	845	117	962	7
62	" .	R. W. Pope ..	813	136	949	8
1	" .	J. Campbell ..	806	130	936	9
37	" ..	C. B. Bertelsmeier .	791	134	925	10
25	" ..	R. L. Appleford ..	774	142	916	11
70	" ..	C. J. Beatty ..	789	127	916	
39	"	W. G. Swift .	757	143	900	13
13	" ..	W. B. Crellin .	753	144	897	14
46	Black Orpingtons ..	H. A Langdon .	778	111	889	15
24	White Leghorns .	Sargenfri Poultry Yards	765	124	889	
48	" ..	Griffin Cant .	760	127	887	17
49	" .	W. Purvis ..	753	133	886	18
29	" .	J. B. Brigden .	757	127	884	19
38	" ..	R. Moy .	750	132	882	20
14	"	J. H. Wright ..	768	108	876	21
33	" ..	H. McKenzie ..	722	150	872	22
45	" ..	Wooldridge Bros. .	783	85	868	23
50	" ..	A. Ahpee	730	136	866	24
44	" ..	A. W. Hall ..	732	131	863	25
2	" ..	B. Rowlinson	736	122	858	26
61	Black Orpingtons .	Jas. Ogden .	756	101	857	27
7	White Leghorns ..	A. H. Padman	715	142	857	
53	" ..	H. Hodges .. .	712	144	856	29
63	" ..	Percy Walker .	709	143	852	30
6	" .	J B. Macarthur .	729	122	851	31
3	Black Orpingtons ..	King and Watson .	767	83	850	32
5	White Leghorns	J. H. Brain ..	695	133	828	33
15	" ..	Mrs. Steer ..	717	102	819	34
42	" ..	Mrs. Kempster ..	679	132	811	35
19	" ..	Cowan Bros. ..	684	126	810	36
30	" ..	Mrs. Stevenson	703	107	810	
35	" ..	C. H. Busst ..	695	109	804	38
10	R.C. Brown Leghorns	S. P Giles ..	667	130	797	39
51	White Leghorns ..	H. Hammill ..	672	116	788	40
64	" ..	H. Merrick .	658	129	787	41
69	" ..	Morgan and Watson .	642	139	781	42
32	" ..	S. Brundrett	634	143	777	43
56	" ..	M. A. Monk ..	655	118	773	44
60	" ..	Miss B. E. Ryan ..	642	125	767	45
65	" ..	A. H. Thomson	634	128	762	46
54	" ..	F. R. DeGaris ..	630	119	749	47
12	" ..	T. H. Stafford ..	602	142	744	48
27	" ..	E. Nash	610	130	740	49
43	" ..	G. Purton	618	118	736	50
8	Black Orpingtons ..	D. Fisher	664	71	735	51
11	" ..	T. S. Goodisson ..	614	121	735	
41	White Leghorns ..	A. Stringer ..	601	127	728	53
57	" ..	B. Walker ..	589	135	724	54
4	" .	J. Blackburne ..	596	123	719	55
52	Black Minorcas ..	Chalmers Bros. ..	581	127	708	56
58	White Leghorns .	W. J. Stock .	588	116	704	57
16	Silver Wyandottes	R. Jobling .	619	82	701	58
66	White Leghorns	J. Moloney .	551	143	694	59
55	Brown Leghorns ..	J. Mathieson .	565	123	688	60
68	White Leghorns ..	W. J. McKeddie ..	536	126	662	61
21	" ..	J. O'Loughlin .	526	117	643	62
22	" ..	W. N. Ling ..	520	118	638	63
67	Anconas	A. E Manning ..	511	120	631	64
17	White Leghorns ..	S. Childs	477	141	618	65
59	" ..	W. J. Seabridge ..	475	133	608	66
18	" ..	B. Mitchell ..	509	82	591	67
34	" ..	R. F. B. Moore ..	468	119	587	68
36	Old English Game	K. J. Barrett ..	466	108	574	69
26	.. .. ..	(Reserved) ..	—	—	—	..
		Totals ..	47,172	8,568	55,740	

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

H. V. Hawkins, Poultry Expert.

MONTHLY REPORT.—FOR MONTH ENDED 14TH DECEMBER. 1912.

The results obtained at the Burnley Competition during the period under review have been highly satisfactory.

Weather.—During the month heavy rain fell at intervals—a total of 417 points having been registered, but, on the whole, the weather has proved good for egg production, being remarkably mild for the season of the year.

The trees planted in each pen have made good growth during the past few weeks, and now provide splendid shade for the birds.

Feeding.—The late rains have been responsible for a good spring of grass, particularly lucerne, and this has been of great assistance to the birds, which are in splendid health.

The lines followed in feeding have been similar to those which appeared in the last report, excepting for one week, when low temperatures prevailed, a ration of maize was then added to the wheat and oats fed at night.

Broodiness.—The large number of White Leghorns that went broody (27) has been a feature of the last month; the heavier breeds were responsible for ten affected in a similar manner.

Mortality.—It is pleasing to record that the mortality list showed that one bird only—in pen No. 70--had to be destroyed. This was due to abnormal condition of the generative organs, three eggs being removed from her weighing over 12 ozs.

Mr. Samuel Brown's pen of White Leghorns continues to hold pride of place, with a total of 1,038 eggs. These birds are laying splendid eggs, of good size and shape, their average weight being a little less than 25 ozs. to the dozen. So far, this pen has not produced a single egg with soft shell; whilst during the month only four "soft" eggs were laid, and three "underweight." This condition cannot be considered as other than highly satisfactory.

On previous page are the detailed returns to Saturday, 14th December.

PLANTING AND RECONSTITUTION OF VINEYARDS.

Conditions governing the Distribution of Phylloxera-resistant Vine Rootlings and Cuttings.

In order to guard against misunderstandings, such as have occasionally arisen in the past, concerning the conditions subject to which intending planters of vineyards may purchase phylloxera-resistant vines from the Department of Agriculture, it is deemed advisable, in the present issue of the *Journal,* to clearly state these conditions.

In previous seasons it has occasionally happened that growers who have failed to lodge their applications within the required time have pleaded want of definite information as to the rules regulating the distribution, and have asked that special consideration be extended to them in consequence.

It may not be out of place to here remind applicants that the Department is situated very differently from a private nursery firm.

which conducts its operations for profit. The propagation and grafting of resistant stocks was undertaken solely in order to help the Victorian vine industry through the phylloxera crisis, by which it was threatened with extinction. Numerous difficulties have had to be surmounted, and considerable sacrifices have been made, vines being supplied to growers at a price which amounts to less than half of what it costs to raise them. In order to prevent disappointment, and to insure the help and co-operation of growers, conditions have been drawn up which intending applicants are earnestly requested to thoroughly familiarize themselves with. *They are warned that under no circumstances can any departure be permitted from the regulations governing the distribution as detailed below, nor can any request for special consideration be entertained.*

Resistant vines are supplied to intending planters in either of the following forms, and at the prices stated:—

Resistant rootlings, grafted with scions previously supplied by applicants, at per 1,000, £4.

Resistant rootlings, ungrafted, at per 1,000, £1.

Resistant cuttings, at per 1,000, 10s.

The conditions which applicants have to comply with necessarily vary for each of these. Before detailing them, the two methods by which a vineyard on resistant stocks can be established may be briefly outlined, mainly for the information of settlers in new districts. These are—

I. Field grafting of resistant rootlings, planted the year before.

II. Planting of nursery-raised grafted rootlings or bench grafts.

Field grafting implies the planting of the vineyard with ungrafted rootlings, which are grafted, the year following their plantation, with scions of the vine variety it is desired to obtain fruit from. Sometimes cuttings are planted instead of rootlings, but unless the season be a very favorable one, results are usually disappointing.

Plantation of Grafted Rootlings.—The term "bench graft" is due to the grafting being performed at a bench or table, in a workshop; the resistant cuttings thus grafted with European scions being subsequently callused in artificial heat and struck in a nursery.

Field grafting is the older method. In Europe it has been very largely superseded by the plantation of grafted rootlings, a more even vineyard being thus obtained in climates where a cold Spring is the rule; cold, wet weather causing many field grafts to fail. In the more temperate climate of Northern Victoria far more satisfactory results can be relied on, and field grafting can be confidently recommended to intending planters. Some practical vine-growers who have tried both methods on a large scale claim to have obtained equal, if not better, results from field grafting.

A common fallacy concerning field grafting must here be corrected. It is often thought by intending planters that they gain a season by planting already-grafted vines. This, however, is not the case. The already-grafted vine cannot bear fruit before the third season from plantation. The field grafted vine commences to bear fruit the second season from grafting. If planted on properly prepared land, field

grafting can be executed the season following plantation; it therefore follows that such vines will commence to bear the third season from planting, or just as soon as the already-grafted vines, planted at the same time.

SELECTION OF SCIONS.

Scions for bench-grafting must be supplied by applicants for grafted rootlings, as will be pointed out presently; but it is well to here urge on intending planters the very vital importance of careful selection of scions, whether these be intended for bench or field grafting.

The improvement of the fruit-bearing capacity of a variety by means of careful selection of cuttings is no new discovery; it has repeatedly been recommended by different officers of this Department,* and its importance is now very generally recognised. It is a point, however, which was for many years much neglected by the majority of Victorian vine-growers, with the result that several of our vine varieties show more or less marked deterioration in their yield of fruit.

In order to secure prolific scions, the best individual vines in a block of any given variety should be carefully marked—quality and quantity of fruit, as well as general health and vigour, are the essential points to be considered in the selection of these scion-bearing vines, which may best be carried out immediately before vintage. Only fruit-bearing canes on the vines thus selected should be used as scions.

APPLICATIONS FOR GRAFTED ROOTLINGS FOR DISTRIBUTION, 1914.

(*For the* 1913 *distribution, the time for receiving applications closed on* 31*st May,* 1912, *and present applicants cannot be supplied till* 1914.)

1. For the 1914 distribution (June to August inclusive) applications must be made before 31st May, 1913, after which date they cannot be entertained.

2. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal Viticultural College, Rutherglen. They must be accompanied by a deposit at the rate of £1 per 1,000 grafted rootlings ordered. In the event of the allotment not being equal to the number applied for, the excess deposit will be applied as a progress payment for those delivered.

3. Scions for grafting, to the number of rootlings applied for and selected as described above, must be delivered by applicants at the Wahgunyah Nursery, or at the Wahgunyah railway station, freight prepaid, between 1st and 30th June, 1913. They must be of medium thickness (minimum diameter at small end ¼ inch and maximum at large end ½ inch), and must be delivered in fresh condition and in good order.

4. On orders for small lots (less than 500 of one scion or stock variety) a surcharge must be paid, to cover cost of extra supervision, of 25 per cent. for lots of 100 and over, and of 50 per cent. for lots below 100.

5. Applicants who supply resistant cuttings (stocks) as well as scions will be entitled to the full number of the grafts which strike.

* See *Journal of Agriculture*—Victoria, 8th March, 1906, p. 189.

6. Prior to distribution applicants must submit the land they intend to plant to inspection, as no grafts will be distributed unless the Department is satisfied that they will be planted on properly-prepared land.

7. The number of grafted rootlings applied for will, before being approved, be subject of adjustment after inspection as provided in the next preceding rule, and in the event of the approved number applied for exceeding the number available, distribution will be *pro rata* of the adjusted and approved quantities.

8. Applicants must pay the balance of purchase money, as specified above, together with cost of packing (of which they will be notified) before the grafts can be forwarded.

9. The nurseries in which grafted rootlings are raised being situated in phylloxerated districts, these cannot be supplied to growers in clean districts. To do so would be manifestly unfair to owners of existing vineyards in such districts.

Applications for Ungrafted Rootlings.

I. For the 1913 distribution (July and August inclusive) applications will be received until 30th June, 1913.

II. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal Viticultural College, Rutherglen. No deposit is required, but payment in full at the rate of £1 per 1,000, with cost of packing added, must be made before the vines can be delivered.

III. Orders for small lots (under 500 of any one variety) to pay a surcharge of 25 per cent. for lots of 100 and over, and of 50 per cent. for smaller lots.

IV. Should the number applied for exceed the number available, distribution will be made *pro ratâ*.

V. Rootlings cannot be sent from nurseries in phylloxerated districts to clean districts. A limited number of clean rootlings are, however, available for distribution to clean districts. The price charged is £1 10s. per 1,000, packing extra. Applications for these will be received by Mr. E. E. Pescott, Principal, School of Horticulture, Burnley, until 13th June, 1913.

Applications for Cuttings.

In the event of not being able to purchase sufficient rootlings (grafted or ungrafted), applicants are reminded that cuttings are available. These may be either planted out immediately in the situation which they are intended to permanently occupy, or they may be previously struck in a nursery; the latter is the course recommended. The distribution of resistant cuttings is subject to the following conditions:—

1. In view of the urgent demand for grafted rootlings, no cuttings of sufficient diameter to be grafted are available for sale. Resistant cuttings of less than ¼ inch in diameter at the small end will be supplied at 10s. per 1,000.
2. Applications for such cuttings, for delivery in July and August, 1913, must be made prior to 30th June, 1913.

3. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal of the Viticultural College, Rutherglen. Payment in full, at the rate of 10s. per 1,000, with cost for packing added, must be made before the vines can be delivered.
4. Clauses 3 and 4 of the regulations concerning ungrafted rootlings apply also to cuttings.
5. Cuttings from phylloxerated districts cannot be sent to growers in clean districts. A limited number of cuttings are available in districts free from phylloxera, and these can be obtained subject to the conditions specified above, but at the increased price of 15s. per 1,000.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, Principal, School of Horticulture, Burnley.

The Orchard.

SPRAYING.

The codlin moth pest should still be fought, and spraying continued to keep it in check. The spraying tests carried out at Burnley last year seem to show that the earlier sprayings are the more valuable, and that very good results were obtained by spraying when the apples were in their young stage of growth. This was shown in the last November *Journal*. At the same time, the second brood will now be maturing, and it will be necessary to spray in order to preserve the fruit from its attacks. As well, all fallen fruit should be destroyed. Pear and cherry trees should be sprayed wherever the pear slug is present, even if there is no fruit on the trees. Japanese plums should also be watched in case the slug should attack these trees.

CULTIVATION.

The unseasonable rains of November and December have given orchardists an excellent chance to work up their ground. The soil is now in very suitable condition for surface cultivation, and the harrows, disc cultivator, or scarifier should be kept going to keep up a good condition of surface looseness. Even where the soil had been previously well cultivated, the cultivators should be again run over the surface, as any succeeding hot weather will cause the soil to form a crust, which would be the means of dissipating a very considerable amount of soil water. Every effort should be taken to retain this moisture, so that the fruit crops shall have all they require for their perfection. To further attain this end no weeds should be allowed to grow in orchard soils.

A good watering, if water be available, should be given to the trees that are maturing their fruit. It is not wise to be sparing of water at this time. A tree that is growing, and carrying fruit, needs all the stimulus that can be given to it in this way. The tree is more likely

to set strong fruit-buds for next season, in addition to perfecting this season's crop of fruit, if sufficient moisture be given to it. Over irrigation should be guarded against, especially in stiff and undrained soils. So long as a tree is growing well, and producing fair average and good quality crops of fruit, the water should be applied but sparingly. The problem to be decided by each grower is, what is the minimum quantity of water to give a tree, in order to produce the maximum results; and this can only be definitely solved by a knowledge of local soil, temperature, and rainfall conditions.

BUDDING.

Young trees, or old trees that have been previously cut down in preparation for budding, may be worked over towards the end of the month. It is advisable to select dull, cool weather for this operation, so that the sap may run more freely, and so that the weather will not have too drying an effect on the bud. The operation of budding is a very simple one, and is easily performed. To gain a successful end, the sap should be flowing freely, so that when the cuts are made the bark should "lift" or "run" easily, and without any clinging or tearing of the fibres; and it should separate freely from the wood. The bud selected should be firm and well matured, and should show no signs of premature growth whatever. It is cut from the scion with a shallow cut, and if any wood in the cutting be left in, this should be taken out of the bud. A smooth clean spot should be selected on the bark of the stock, and a T-shaped cut made; the vertical cut being longer than the horizontal one. The bark at the point where the cuts meet should be raised, and the bud inserted between the bark and the wood of the stock. The bud should be gently pushed down into position, and it should then be bound with soft twine, string, or raffia. If the bud be too long for the cut, the top may be cut off level with a horizontal cut. With practice, it will soon become possible to cut buds that will need neither cutting nor trimming.

After two or three weeks the buds may be examined to see if they have "taken"; that is, if the bud has united thoroughly to the stock. When that occurs the tie may be cut. If a growth be desired at once, all wood above the bud may be cut off some short distance above the bud, so as to prevent any bark splitting and consequent loss of the bud, and so as to throw the bud out at a fair angle. Ultimately, this should be properly trimmed.

If desired, the bud may be left dormant throughout the autumn and winter till next spring. In this case, the branch above is not cut off, but is left on until the usual winter pruning.

SUMMER PRUNING.

The profuse rains of November and December have caused a very vigorous growth in the fruit trees by considerably prolonging the growth period. In order to more economically utilize this abundant growth, it should be now summer pruned, particularly on the apple and pear trees. Care should be observed that as much of the leafage as possible is retained on the trees. Unduly long laterals of fruiting

trees may be shortened back, always cutting to a leaf. Unnecessary terminal leader growths, of which there are sometimes three or four, all strong growing, may be reduced to one; retaining this one as a leader. In no case should this growth be cut or interfered with in any way.

The results of these cuts will be to divert the sap which was flowing into growths that would subsequently be pruned into more profitable channels, so that weak buds and growths may be strengthened, and induced into fruit bearing.

Vegetable Garden.

The work in this section is much the same as in the flower garden. Frequent waterings, good mulching, and regular soil stirring will be the work for the month. As soon as any bed is cleared of vegetables, it should be manured and well dug over in preparation for the next crop. Deep digging is always desirable in vegetable growing. If any pest, such as aphis, caterpillars, or tomato weevil have been present, it would be advisable to burn all the crop refuse, to destroy any insects that remain, and to give the plot a good dressing of gypsum or of Clift's Manurial Insecticide.

Keep the tomatoes well watered and manured, pinching out surplus and strong-growing laterals. In early districts the onion crop will be ripening. In late districts, or with late crops, the ripening may be hastened by breaking down the top. An autumn crop of potatoes may be planted. Cabbage, cauliflower, lettuce and celery plants may be planted out.

Flower Garden.

January should be a busy month in the garden. The waterings will be constant and frequent; and after every watering the surface should be well loosened and stirred with the hoe, to keep it moist and cool. More cultivation and less water is a good rule to be observed. If the hoe be used more and the hose less in summer, greater benefits will accrue, and the water bill will be considerably reduced. Mulchings with straw, grass, &c., are very useful just now. The mowings from lawns form valuable mulching; waste tobacco stems are also valuable as a mulch.

Dahlias, chrysanthemums, and other tall-growing slender herbaceous plants will require support in the way of stakes; they will also need mulching considerably. These plants should receive no check whatever, but should be continued with a regular even growth right through the season. Another desideratum is that the soil should be well drained. Plants of all descriptions thrive far better in well-drained soils, and they require a far less amount of water.

A sharp lookout should be kept on these plants for attacks of red spider; if this insect appears, a good spraying with tobacco solution or benzole emulsion should be given to the plants.

Constant watch will need to be kept for the various small caterpillars that attack the buds of these plants. Spraying with a weak solution of Paris green and lime, or similar insecticide, will be useful; hand-picking should also be resorted to.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 2. 10th February, 1913.

WHEAT AND ITS CULTIVATION.

No. 10.—WHEAT IMPROVEMENT.*

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

(*Continued from page* 56.)

The second method of effecting specific improvements in plants is by means of cross-breeding or hybridization.

In effecting improvements by cross-breeding the mode of procedure is to cross two varieties of wheat possessing divergent and complementary characteristics, and selecting from the widely varying progeny those particular individuals which possess in the highest degree the specific qualities which we are seeking.

In order to effectually apply such a method it is necessary to have a clear conception of the goal towards which improvement is to be wrought, a knowledge of the unit characters of the different varieties, and of the laws governing the inheritance of these unit characters.

The act of crossing, and the actual production of merely new varieties is simplicity itself—the fixing and production of valuable varieties is extremely difficult.

Structure of the Wheat Flower.

Before discussing the method of crossing wheats, let us consider briefly the structure of a flower of wheat. The " head " or " ear " of wheat is known in botanical language as a spike, and consists of a flattened stem or rachis bearing alternately a series of structures known as " spikelets." Each " spikelet " or " chest " consists of several flowers. Usually each spikelet of most varieties has three to five flowers, from each of which a grain of wheat may develop. The flower itself consists of two parts—

(*a*) the protective parts, consisting of glumes and pales.

(*b*) the essential parts—the stamens and pistil—*i.e.*, male and female organs. (Fig. 1.)

* Portions of this and the previous article formed a paper read at the Australasian Association for the Advancement of Science, January, 1913.

We are concerned here especially with the essential organs. The stamens (St.) are three in number, and represent the male organs. Each stamen consists of a slender stalk—the filament, bearing at its summit the anther or pollen sacs, which in the case of the wheat plant consists of four longitudinal chambers containing large numbers of minute pollen grains (sperm cells).

The female portion of the flower—the pistil—consists of the ovary with a minute ovule (or egg cell). The upper part of the ovary bifurcates and forms two long, slender, feathery structures—the styles. (Fig. 1).

The pollen grain falls on the stigma of the flower and "germinates" sending a slender prolongation through the style until it reaches the ovule when fusion and fertilization takes place.

How the crossing is done. In the case of the wheat plant the flowers are normally self-fertilized. Natural cross fertilization is very rare. Moreover the flowers are hermaphrodite, *i.e.*, male and

FIG. 1.—FLOWER OF WHEAT (MAGNIFIED).

female elements are borne on the same flower. The wheat plant is said to be in "flower" when the anthers begin to extrude from the glumes. With wheat, however, fertilization takes place before "flowering." In order to cross one variety with another it is necessary that the pollen of one variety should be dusted on the ripe stigma or female part of the second variety. The plant from which the pollen is taken is generally described as the male parent, whilst the plant on which the crossing is done is referred to as the female parent. I find the following method gives satisfaction. A well developed "ear" of the "female parent" is chosen and prepared in the following manner:—

> The basal spikelets amounting to approximately one-third of the ear are stripped off, and the top third of the head removed with a pair of scissors. About four or five spikelets are thus left on each side of the centre of the ear. These spikelets invariably contain three to five flowers. All flowers save the outside pair are removed with a pair of

forceps. Thus the ear is reduced to twelve to twenty flowers (Fig. 7). It is now necessary to "castrate" the flowers by removing the three anthers from each. The point of the forceps is gently inserted between the upper margins of the inner and outer pales, and, by releasing the pressure on the forceps the flower is gently forced open exposing the three anthers and the feathery stigma. With a little practice these anthers may be removed unbroken with one stroke of the forceps. It is, of course, necessary to prepare the ear in this fashion before any of the anthers have shed their pollen grains. The best stage at which to carry out the operation is when the anthers are just approaching maturity and turning yellow in colour. Having castrated the whole of the flowers by the removal of all traces of the anthers, the ears may be wrapped in cotton wool until the stigmas of the flower become "receptive" or ready to receive the pollen. The cotton wool may then be removed, and ripe anthers of the particular variety desired as the male parent should then be secured. The anthers should be quite "ripe" *i.e.*, bright yellow in colour, and just ready to burst. The anthers are seized with a fine pair of forceps, broken in halves, and the contents gently shaken or dusted over the feathery style of the female ear. Each flower is treated in succession in this way, and frequently, when the pollen is not in good condition, some of the anthers may be broken and left inside the protective glumes of the flower.

Instead of castrating and pollinating the flowers on different days it is generally more convenient to remove the anthers and cross-pollinate the stigmas at the one operation. It is necessary in such cases that the stigma and anthers should be fairly "ripe," and care should be taken that self-fertilization does not occur. Any flowers in which the anthers have already liberated pollen should be suppressed.

After the crossing is finished the ear is wrapped up in cotton wool, or surrounded with a light paraffined paper bag to prevent the possible entry of foreign pollen. The ear is then labelled with the names of the male and female parents, date of cross, &c., and supported by a stake (Fig. 8). A fortnight later the protective covering may be removed, and the ear allowed to ripen.

EFFECTS OF CROSSING.

It is interesting to note, in passing, the general effect of crossing two different varieties of wheat:—

(*a*) *Crossing Increases Vigor of Progeny.*

Darwin made an exhaustive comparative study of the effects of self-fertilization and cross-fertilization in plants. He has summed up his researches in the generalization that "**Nature abhors perpetual self-fertilization.**" He showed that crossing within the limits of the species resulted in the production of a very vigorous offspring, while self-fertilization tends to weaken the offspring, and that flowers as a general rule

are constructed in such a manner as to favour cross-fertilization. In the case of wheat, however, it must be remembered that the flowers are normally self-fertilized, and that cross-fertilization under natural conditions is extremely rare. There can be no doubt that in the cross-breeding of wheat the immediate effect is a general marked increase in the vigour of the cross. This increased vigour finds its expression generally in increased height, increased stooling capacity and size of head in the cross-bred progeny. Whether this increased vigour is, however, a permanent characteristic or a mere temporary improvement has not been definitely established in the case of wheat.

(*b*) *Crossing "breaks the type"* and induces variation. Cross-breeding is one of the most powerful methods of inducing variations in a given type. There is no variety of wheat grown at the present time but what has some serious defect. It frequently happens that given varieties are specially well dowered with certain desirable qualities, but are sadly deficient in other necessary qualities. It is now possible by systematic cross-breeding to combine the desirable qualities of two or more individual types in one variety, and eliminate any undesirable qualities. Farrer relied almost entirely on this method for the production of his new varieties. Federation, the most popular and prolific wheat in general cultivation in Australia at the present time; Cedar, Bobs, and Comeback, wheats of the highest milling excellence; Florence and Genoa, varieties which are smut resistant; and Bunyip, Thew, Bayah, Firbank, Warren, Jonathan, and a host of others have been produced by Farrer by means of cross-breeding. It is by means of the variations induced by crossing that improvement on existing types becomes possible.

Obviously, the wider initial differences between the two plants the more widely will the progeny vary.

DO THE VARIATIONS FOLLOW DEFINITE LAWS?

Some idea of the difficulties which beset the early workers on this field of inquiry may be gathered from the history of a typical cross-bred seed. Suppose, for example, the variety known as Clubhead, which is a stiff-strawed, beardless, dark-chaffed variety with a dense compact head, be crossed with Yandilla King, which has a long, white, somewhat open head with firm closing glumes. The plants of the first generation will invariably be slightly clubby in character with reddish-brown chaff. Now from this single cross-bred plant a thousand seeds might be produced. If every one of these seeds be separately sown the next season an unending variety of plants will arise.

Every gradation and combination between the characteristics of the Clubhead on the one hand and the Yandilla King on the other appear to make themselves manifest in this generation. Indeed, characters appear in this generation which were latent in the

originals, *e.g.*, many of the progeny will be found with beards. Apparently chaos is the result of this simple act of crossing. Further, if a few grains be selected from each of the thousand plants and again be sown separately, it will be found that in the third generation some of the plants breed true to type whilst others give still further complex variations. This apparently chaotic result arising from the growing of a single cross-bred seed puzzled and confounded the early hybridizers and investigators. If by cross-breeding plants possessing specific characteristics the progeny were found to obey no definite laws it follows that the improvement of plants by this method would be nothing more than a mere gamble.

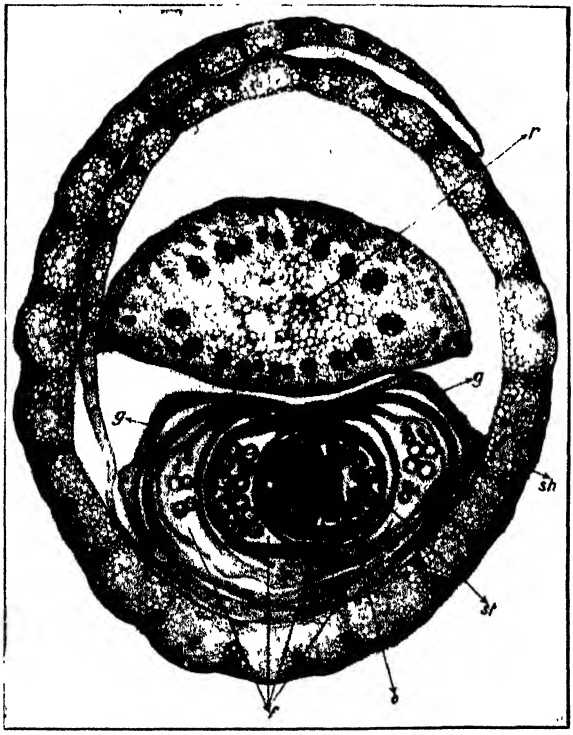


FIG. 2.—TRANSVERSE SECTION THROUGH SPIKELET OF WHEAT SHOWING RELATION OF PARTS.

r, Rachis or Stem, f, Flowers, st, Stamen of Flower, o, Ovary of Flower, g, Glumes; sh, Sheath.

Lindley, indeed, some fifty years ago, declared that the improvement of plants by cross-breeding was a game of chance with the odds in favour of the plant.

If, on the contrary, the laws of inheritance of specific characteristics could be formulated and definitely known it manifestly follows that the work of plant improvement would be reduced to scientific exactness.

Gregor Mendel, monk and abbot, of Brunn, in Austrian Silesia, was the first to unravel this tangle, and present to the world a clear and lucid exposition of the inheritance of specific characters in cross-breeding.

Mendelism.

Mendel communicated the results of his now world-famous experiments to the local scientific society in 1865, but, strangely enough, they lay unnoticed until 1900, when they were rediscovered and independently confirmed by De Vries, Correns, and Tschermak.

Mendel realized that the failure of the early hybridizers to elucidate the general principle of inheritance from the results of cross-breeding was due to the fact that they did not concentrate their attention on definite characteristics of the plant, and trace the inheritance of these characteristics through a sequence of generations. After a great deal of experimenting he decided to use the common pea for his investigations. A close examination of the different varieties in cultivation enabled him to separate 22 distinct types. He arranged these pure races into pairs of opposite or contrasting characters and crossed representative plants of each pair separately. Thus he crossed tall peas with dwarf peas, peas with angular seeds with those possessing rounded seeds, &c. He carefully preserved all the progeny of every cross-bred plant and planted them separately each year. In the case of the cross between the tall and dwarf pea, the progeny of the first generation were all talls. This property or character of tallness, Mendel, therefore, described as dominant, whilst the opposite attribute dwarfness, which appeared to be masked, he described as recessive. The plants of this generation were allowed to fertilize themselves, and the offspring of each plant were separately sown. In the second generation it was found that one-quarter of the progeny regularly resembled the recessive parent, and constantly bred true to type. The remaining three-quarters of the progeny resembled the dominant parent. That is to say, there were three times as many talls as there were dwarfs in the second generation of the hybrid. It was found that the recessives bred true to type for countless generations, *i.e.*, they always gave rise to plants that were dwarf in character. The dominants, however, when allowed to fertilize themselves did not all breed true, but gave rise to plants of two kinds—

Fig. 3.—Pollen sac (anther) containing numerous pollen grains (x 40).

(*a*) *Impure* dominants which in the next generation gave a mixture of both talls and dwarfs in the proportion of three talls to one dwarf.

(*b*) *Pure* dominants which produced talls only, and were thus pure to tallness.

Moreover, statistical examination of these two types revealed that there were *exactly twice* as many impure dominants as there were pure dominants. In other words, the third generation of the original hybrid consisted of three different types of plants.

Pure Dominants, 25% -- Impure Dominants, 50% — Recessives, 25%

3 Dominants 1 Recessive

These interesting results obtained during the first three generations by crossing the tall and the dwarf peas may be summarized by the following diagram, where D represents a true breeding tall plant—the Dominant character, and R the Recessive character, a pure breeding dwarf plant; and D(R) an Impure Dominant, *i.e.*, a tall which on self-fertilization gives both talls and dwarfs in the ratio of 3:1.

D × R — P.—Parents.

D(R) — F.1.—First Generation.

D, D(R), D(R), R — F.2.—Second Generation.

Pure Dominant. Impure Dominant. Impure Dominant Pure Recessive

D D D(R) D(R) R D D(R) D(R) R R — F.3.—Third Generation.

Besides tallness and dwarfness other contrasted pairs of characters were experimentally dealt with, and it was found that they followed the same law of inheritance. Thus coloured flowers were found to be dominant to white, and the first generation consisted of coloured flowers. In the second generation there were three times as many coloured flowers as white. The white flowers were found to breed true to type, but of the coloured flowers the ratio of pure types to impure types was as 1:2.

One naturally wonders what would happen if two plants possessing two pairs of contrasting characters were crossed together. For example, suppose a tall pea with coloured flowers were crossed with a dwarf pea with white flowers, how would the respective characters be distributed in the progeny? In this Mendel found that each pair of characters followed the same rule, and that the inheritance of each was quite independent of the other.

When the tall coloured pea was crossed with the dwarf white pea, the progeny of the first generation were all tall coloured plants, for tallness was dominant to dwarfness, and coloured flowers were dominant to white.

When this hybrid was self-fertilized the second generation gave four kinds of plants, namely, coloured talls, coloured dwarfs, white talls, white dwarfs. Further, it was found that the plants with coloured flowers were three times as numerous as those of the plants

with white flowers. Similarly there were three times as many talls as dwarfs. In this generation, the four forms were actually found to be present in the following ratios, namely:—

9 coloured talls, 3 white talls, 3 coloured dwarfs, 1 white dwarf. And this is the only ratio which can satisfy the condition that the coloured should be to the white as 3:1, and at the same time the talls should be to the dwarfs as 3:1. These results may be concisely summarized as follows:—

FIG. 4.—STIGMA OF WHEAT FLOWER SHOWING ADHERENT POLLEN GRAINS (x 25).

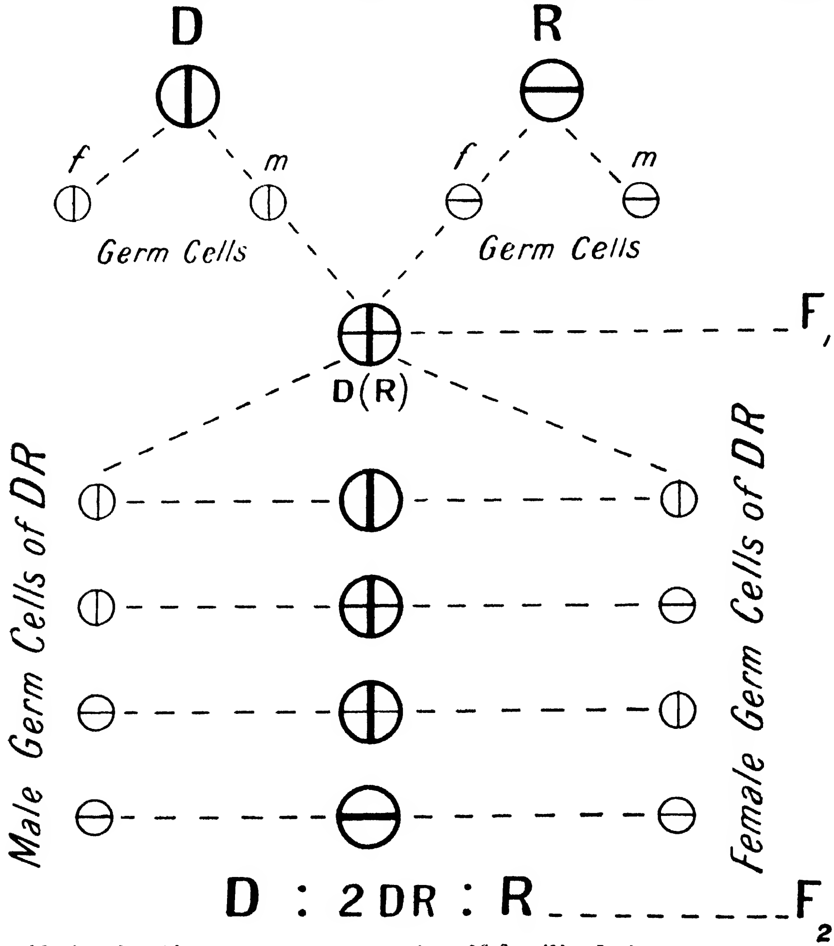
When two plants exhibiting two pairs of contrasting characters are crossed together, the progeny of the first generation consists of plants bearing the two dominant characters, whilst in the second generation the characters segregate with the following proportion:—Nine plants possessing the two dominant characters; three plants exhibiting one dominant and one recessive; three plants exhibiting the other dominant and the other recessive; and only one plant with both the recessive characters. This principle may be extended to three or more pairs of different characters.

WHAT WAS MENDEL'S EXPLANATION OF THESE FACTS?

After Mendel had experimentally determined the scheme of inheritance for each of the seven pairs of differentiating factors which engaged his attention, he attempted to provide a theoretical interpretation to fit in with the observed facts. He assumed in the first place that each germ cell or gamete could carry a factor which could give rise to one or other of the differentiating pair of characters, *e.g.*, any given germ cell could carry the attribute or factor either for tallness or for dwarfness, but *not for both*.

These two attributes were mutually exclusive so far as the gametes are concerned. When a pure tall plant produced gametes or germ cells each bore the attribute for tallness. Similarly the gametes of the dwarf plants all bore the attribute of dwarfness. When the tall pea is crossed with the dwarf pea a gamete bearing the attribute of tallness mates with a gamete bearing the attribute of dwarfness. Inasmuch as the attribute of tallness is dominant, the hybrid progeny will be in appearance similar to the pure tall plant. This hybrid

tall, however, will differ markedly from the pure tall plant when it produces gametes. Mendel assumed that when it forms gametes the elements representing tallness and dwarfness segregate from one another, and of the total number of gametes formed one-half contains the one element, and one-half the other. That is to say, when this hybrid plant forms its germ cells—pollen grains and egg cells—one-half of the pollen grains will possess the dominant character, and one-half the recessive character. Similarly one-half of the egg cells (ovules) will carry the dominant attribute, and one-half the recessive.



Obviously, if this hybrid plant is self-fertilized there are four and only four combinations possible, namely:—

(*a*) A dominant pollen grain with a dominant egg cell. DD.
(*b*) A dominant pollen grain with a recessive egg cell. DR.
(*c*) A recessive pollen grain with a dominant egg cell. DR.
(*d*) A recessive pollen grain with a recessive egg cell. RR.

and the proportion of each must be:—

DD: 2DR: RR.

which corresponds to Mendel's Law.

The above schematic representation may assist in making this clear:—

CONFIRMATION OF MENDEL'S RESULTS.

Mendel's work has been confirmed by many workers in widely different fields of investigation. Besides Correns, Tschermak, and De Vries, who were responsible for the rediscovery of Mendel's work, there have been confirmatory contributions by Darbishire on Mice, Hurst on Rabbits, Davenport on Poultry, Vilmorin, Nillson-Ehle, Biffen, Spillman, and Howard on Wheat, Bateson, Saunders, and others on Lychnis, Atropa and Matthiola, and Toyama on Silkmoths.

CAN THESE PRINCIPLES BE APPLIED TO THE BREEDING OF WHEAT?

It is of great practical importance to know whether the laws of inheritance already formulated may be applied in practice to the improvement of wheat. A considerable amount of data has accumulated during recent years on the inheritance of unit characters in wheat, and this tends to show that—

(1) The process of "fixing" new crosses, which formerly required considerable time and a vast amount of labour, may be greatly simplified.

(2) The wheat breeder can predict with a tolerable amount of certainty what combinations of unit characters may be associated and fixed in a new variety.

(3) The breeding of new varieties possessing certain specific attributes and desirable qualities may be accomplished with certainty.

The most prominent investigators in this field of work are Tschermak,* Spillman,† Biffen,‡ Nillson-Ehle§, and Howard‖. The first essential of course is to determine what characteristics in wheat are dominant and what recessive. *Tschermak** after an exhaustive and critical study of the behaviour of the various contrasted unit characters in wheat states that the following attributes are respectively dominant and recessive, in strict accordance with Mendel's law:—

Table of Contrasted Characters in Wheat (Tschermak).

Dominant	Recessive
Hairy leaves	Smooth leaves
Solid stem.	Hollow stem
Firm closing of glumes.	Loose closing of glumes.
Felted glumes.	Smooth glumes
Black chaff.	White chaff.
Flinty grain	Floury grain.
Winter form (late shooting).	Spring form (early shooting).
Lax ears.	Dense ears.

These have been confirmed in general by Biffen and Spillman, though in the case of bearded and beardless wheats the ratios are often very far from following Mendel's law, as Saunders,** Howard,†† and others have pointed out.

* *Tschermak*— Die Zuchtung der landw. Kultur Pflanzen Bd. IV 1907.
† *Spillman*—Science XVI. 1902.
‡ *Biffen*—Journal of Agric. Science 1905, 1907, 1908, 1909.
§ *Nillson-Ehle*—Kreizurgsuntersuchungen an Hafer and Weizen Lund, 1909–1911
‖ *Howard*—Memoirs of the Imperial Dept. of Ag. India, Vol. IV., No 8, Vol. 5, No. 1.
** Saunders' Inheritance of Awns in Wheat, Conference on Genetics, 1906, p. 370.
†† Howard (*loc. cit*).

Biffen has obtained similar results at Cambridge. In addition he has shown that the following characters behave as Mendelian units:—

Dominant	Recessive
Red Grain.	White Grain.
Hard Translucent Endosperm.	Soft Opaque Endosperm.
Susceptibility to yellow rust.	Immunity from yellow rust.

In the following characters there is no dominance of either character, and the progeny in the first generation are intermediate:—

Lax and dense ears.
Large and small glumes.
Long and short grains.
Early and late ripening.

In the second generation two of the intermediates occur to each pure character. D: 2 DR: R.

The determination of the mode of inheritance of these various unit characters is of the greatest practical importance, for it enables the breeder to predict with tolerable certainty the forms resulting from the mating of two plants whose qualities can be expressed in terms of one or more unit characters.

FIG. 5.—STIGMA OF WHEAT FLOWER HIGHLY MAGNIFIED SHOWING NUMEROUS ADHERENT POLLEN GRAINS.

One of the most interesting of the researches carried out in the production of new varieties of wheat is that done by Biffen in the production of the apparently impossible combination in the one variety of prolificacy, resistance to yellow rust, and high strength.

The wheats grown in England are very low in strength, and this defect is reflected in the disparity in price at Mark Lane between the Home-grown wheat, and the strong foreign wheats like Manitoba No. 1. It was formerly thought that this low strength of the wheats grown in England was due to the peculiarities of the climate.

A trial of a large number of foreign varieties of high strength under English conditions proved that while the greater majority deteriorated immediately, there were a few varieties which retained their strength perfectly under the new climatic conditions, and gave as good results in the bakehouse as when grown in their native lands. These varieties, however, were of little use to English farmers, for

they lacked yielding power of both grain and straw. Biffen, therefore crossed these varieties of high strength with the prolific English varieties with the object of obtaining suitable varieties of high strength. Strength is defined as to the capacity of the flour "to yield large well-piled loaves,"* and while it is not an easy matter to give in non-technical language the difference in strong and weak wheat, it may be said that in general strong wheats are characterized by hard more or less transparent endosperm, whilst weak wheats are usually soft, starchy, and opaque. In a certain cross between Red Fife and Rough Chaff a statistical examination of that progeny revealed the fact that in the first generation all the plants possessed strong grain, and that in the second generation the strength and weakness behaved as Mendelian characters giving the following ratio :—Nine strong red, three strong white, three weak red, one weak white. Biffen showed that these characters of strength and weakness in wheats could be handled with the same definiteness as other Mendelian characters.

FIG. 6.—STIGMA OF WHEAT FLOWER HIGHLY MAGNIFIED SHOWING POLLEN GRAIN IN THE PROCESS OF FERTILIZING THE OVULE.

Similar results were obtained with the inheritance of yellow rust (*Puccinia glumarum*) which does great damage in England.

Crosses between varieties which were immune from yellow rust and Michigan Bronze, a variety inordinately prone to rust, gave a first generation crop of hybrids which were as badly affected with rust as Michigan Bronze itself. A statistical examination of the second generation plants gave 1,603 diseased plants and 523 immune, or a ratio of 3.07 : 1. Apparently, therefore, immunity and susceptibility to yellow rust behave like Mendelian characters.

It is not known to what the resistance of the rust is due. Working with Professor Biffen Miss Marryat found that the rust hyphæ are checked after entering the stomata of the resistant plants. Bateson points out that if the resistance to yellow rust is due to the presence of some anti-toxin the dominance of susceptibility must be taken to indicate that the formation of the anti-toxin is prevented by the presence of a factor in the dominant form, a conclusion which may lead to definite progress in the physiology of disease resistance. This yellow rust (*Puccinia glumarum*) is not the rust so frequently

* T. M. Wood, Chemistry of Wheat and Flour, *Journal of Agri. Science*, 1907.

found in Australian wheat fields. The species of rust which causes so much damage here is *Puccinia graminis.*

Many of the unit characters so far studied in wheat have been those which are of relatively little value to the practical agriculturist. The colour of the chaff, the character of the awns, the hairs on the glumes, &c., are of great interest from a scientific point of view, inasmuch as a systematic study of them will serve to throw much light on obscure problems of inheritance, but they are of infinitely less practical utility than such characteristics as prolificacy, drought resistance, and early maturity.

Unfortunately very little work has been done in regard to these important practical properties, and a systematic analysis of the factors on which these qualities depend, and of their mode of inheritance is urgently required. We do know that the prolificacy of any variety of wheat is a complex of many factors. The yield depends on the climate; the chemical, physical, and biological condition of the soil; and on the qualities inherent in the variety.

Of the qualities inherent in the variety the most important are the capacity to develop a vigorous root system, and to stool strongly. Other factors are the average length and density of the ears—the number of fertile florets carried to each spikelet, and the average size of the grain. We do not know, however, as yet whether high yielding and low yielding capacity behave as Mendelian characters and segregate as such in the second generation.

The production of drought-resisting wheats is a problem of peculiar importance to Australia, since the expansion of the margin of profitable cultivation is largely dependent on what success can be achieved in the confines of our existing wheat areas. It is a matter of common observation that among the many varieties of wheat that are grown at present there are some that could not be expected ever to do well in the dry areas. These are the very late varieties, and those which produce an abundance of foliage. Varieties such as Manitoba, Red Fife, Power's Fife, Huron, Marquis, &c., ripen far too late to be of value in our dry areas. While a great deal may be accomplished by scientific effort in the production of new varieties suitable for our driest areas, it is not reasonable to expect that more would be accomplished in a decade in this way, than by centuries of care by past generations of wheat-growers under arid conditions.

FIG. 7.—HEAD OF WHEAT PREPARED FOR CROSSING.

a. Before Treatment.
b. Same head after treatment. Showing suppression of upper and lower spikelets and portion of median spikelets.

That is to say, the production of drought-resisting varieties is likely to be successful if we use as foundation stocks those varieties

which have been grown for generations under the very driest conditions. Among wheats that might be useful in this direction are the durum wheats, and certain early maturing varieties which are regularly grown under arid conditions in India.

Such varieties growing habitually under arid conditions might be expected to develop qualities which innure them to their environment. In the course of generations these qualities of resistance to arid conditions might be expected to become hereditary. Structural changes might be expected to develop such as increased root system, diminishing leaf and transpiration surface, and possibly a decrease

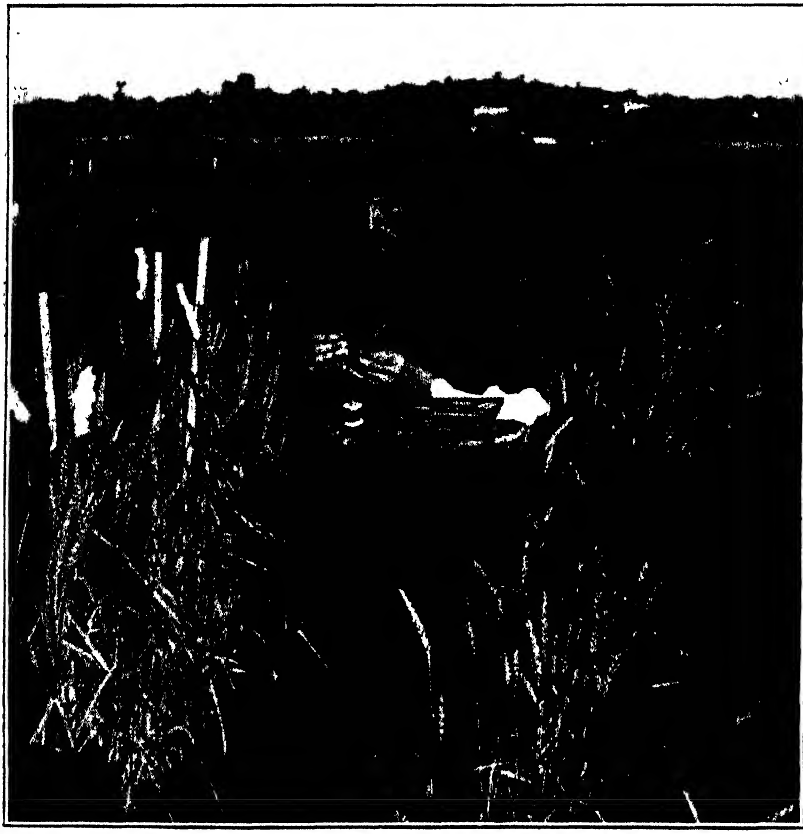


FIG. 8.—CROSSING WHEATS AT RUTHERGLEN EXPERIMENT FARM, 1912.

in the size and number of stomata per unit area, and a decrease in the proportion of straw to grain.

If to such qualities as these that of rapid maturity could be added we should have varieties which might be expected to do well in a dry and rigorous climate such as obtains on the confines of our wheat areas.

Some six years ago a large number of Indian varieties were obtained by the South Australian Department for trial at Parafield. Many of these proved to be of little value, but there were nine varieties in all from the Punjaub which were remarkable for the

extreme earliness of ripening and their resistance to droughty conditions. These wheats usually grow 12 inches to 15 inches high, but they are remarkable for the small amount of narrow upstanding flag produced in comparison with the grain. Moreover, these Indian varieties are extremely early, and by cross-breeding them with some of our local varieties it has been possible to produce new varieties which mature considerably earlier than the variety on which they were crossed.

FIG. 9.—GRASS TUFT WHEAT PLANT SHOWN BY ARROW.
Rutherglen Experimental Plots, 1912.

The value of early maturing varieties in a dry season such as we have experienced in Victoria during 1912 must be obvious.

Compared with late maturing varieties the early varieties are able to make vigorous growth, and get well on the way towards maturity, and beyond reach of injury before the hot dry winds of early summer come on.

GRASS TUFT WHEATS.

In the raising of cross-bred varieties it frequently happens that certain of the crosses bear in more or less regular ratio a number of peculiar, stunted looking plants, which at first sight appear to be tufts of grass. These grass-like tufts, however, are really wheat plants of a very inferior character. They usually contain numerous crowded leaves, narrower, shorter, and more erect than

ordinary wheat plants, and, though they generally die off before heading out, occasionally give rise to a few short stunted-looking heads. It may be thought that these plants have resulted from defective nutrition, and that for this reason the plant was not able to complete its structure; in other words, that they are merely cases of arrested development.

The fact that these grass tuft plants occur regularly in the second and third generations of certain wheat crosses, and are not found in the standard varieties of wheat grown under similar soil conditions indicates that the cause must not be looked for in the environment.

At Longerenong, during 1912, out of 15,800 plants sown in the cross-bred hand plots 28 grass tuft wheats were observed, whilst not a single plant was observed in the 35,000 plants in the standard selection plots. At Rutherglen 45 such plants appeared in 18,500 cross-bred plants, while none appeared in ordinary variety plots. The tufts appeared on twelve different crosses, of which six were crosses with Indian wheats. The average height of the tufts was 9 inches. Less than 50 per cent. formed heads, and only 9 per cent. formed grain. Farrer* observed a number of these grass clumps in his cross-bred plots from time to time, and noted that the grass clump plants were "produced in the greatest number by first crosses between widely different types of bread wheats (*T. Sativum*), and appear to be produced by crosses between bread wheats alone."

Farrer planted a number of seeds from these grass clump plants, and found that while in some cases all were grass clump plants, in others the seeds gave mixtures of grass clumps and wheat plants. He assumes that these are "reversions," and suggests that a systematic experimental investigation of these grass clump plants would probably make known to us the number of species from which the different cultivated bread wheats are descended, and would give a clear idea of the botanical characters of these ancestors, and enable us to identify any that may still be in existence.

Conclusion.

During the past few years efforts have been made by ardent enthusiasts to extend Mendel's law to all branches of animal breeding, and to make it fit in with our present day knowledge. Interesting results have certainly been obtained in the cross-breeding of poultry, mice, rabbits, and polled cattle, but a considerable amount of ingenuity will be required to explain many of the discrepant and discordant results obtained with sheep and pigeons, &c.

Whatever the future may have in store in the practical application of Mendel's work to Animal Breeding, there can be no doubt that the present day breeder can, with the aid of the key given by Mendel, proceed on his work of plant improvement without leaving much to chance. The best results will follow when the individual plant is regarded as being built up of a number of unit characters, each of which follows a definite scheme of inheritance. The terms dominance and recessiveness should be applied, not to individual plants, but to each of the unit characters which collectively make up

* Farrer, "The Making and Improvement of Australian Wheat," *Agricultural Gazette of New South Wales*, 1898.

the organism. The scheme of inheritance of many of the unit characters have been worked out in detail, but there are qualities of

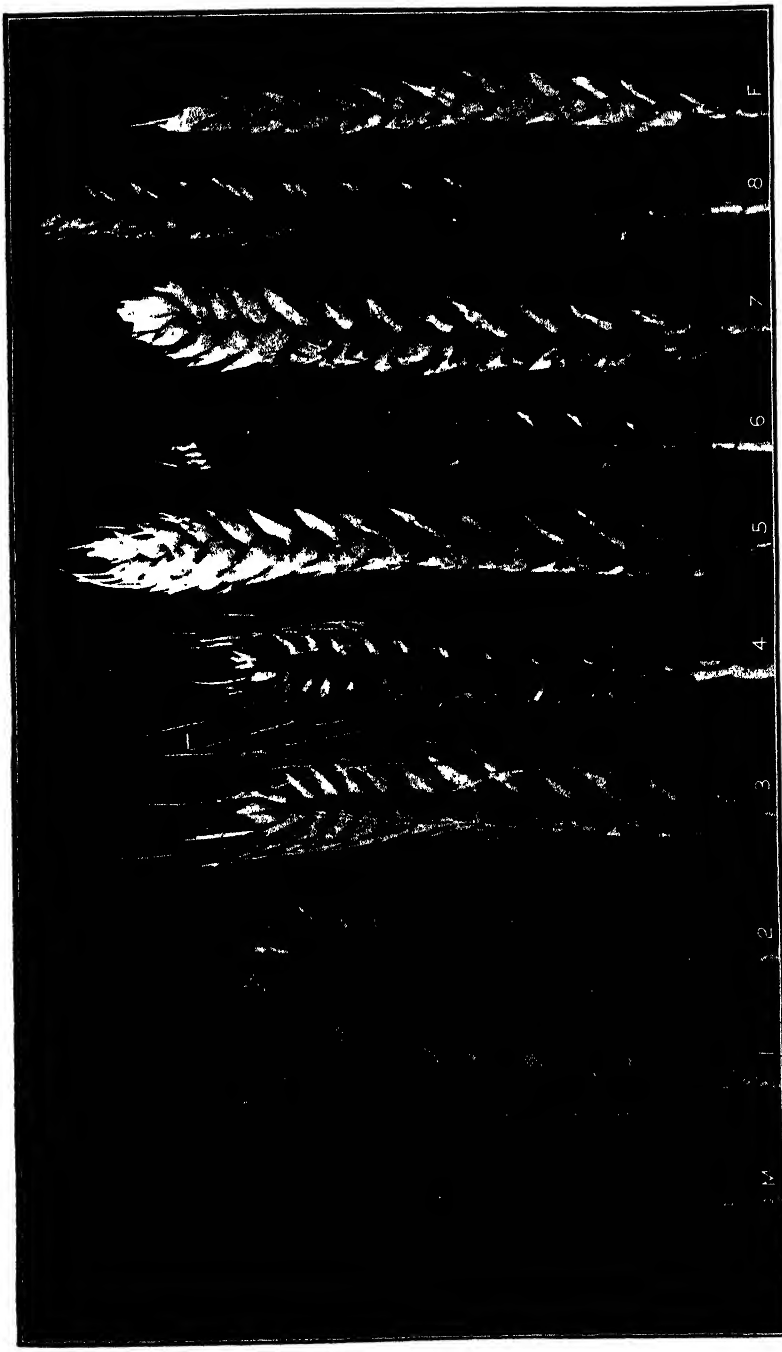


FIG. 10.—CROSSBRED TYPES PRODUCED BY MATING CLUBHEAD (MALE PLANT) WITH YANDILLA KING (FEMALE PLANT).

M, Club head (bronze red); F, Yandilla King (white); 1, 2, 3, 4, 5, 6, 7, 8, Some of the second generation crossbred progeny, showing variations in colour and structure of head.

great practical importance which require further investigation. We require to know exactly what are the various factors on which these important qualities depend, whether they conform to the Mendelian scheme of inheritance, and whether they are transmitted independently of other factors, or in association, and, if so, how close the association is.

The aim of the wheat-breeder is always an improvement in type, the production of varieties possessing the maximum of desirable qualities, and the minimum of undesirable attributes. If he knows that the desirable qualities he is seeking are in two or more strains it is his task to unite the desirable qualities in the one strain. His most important problem is to determine by analysis and experiment the factors on which the desirable characteristics depend. But as soon as these factors have been determined, and their mode of inheritance investigated, they can be brought under control and associated together at the breeder's will.

SUMMARY.

1. The enriching and improving of the soil has been the dominant note in our system of wheat farming during the past generation.

2. There is reason to believe that as much attention might profitably be given to the improvement of the plant as there has hitherto been given to the improvement in its environment.

3. The primary aim of wheat improvement is the production of prolific varieties. Other important considerations are milling quality of grain, drought resistance, and rust resistance.

4. Extraordinary activity is being displayed throughout the world in wheat improvement.

5. Varieties may be improved by selection and cross-breeding.

6. Every care should be taken by farmers to get (*a*) the right variety of wheat, (*b*) well-developed seed, (*c*) seed from the most vigorous plants.

7. The common beet containing 6 to 7 per cent. of sugar has been developed into the sugar beet containing 20 to 25 per cent. of sugar by systematic selection.

8. Selection is based on variation.

9. Most variations are small, and diverge only slightly from the mean of the species. Others are large, and vary widely from the mean (mutations).

10. There are two general methods of selection (*a*) mass selection, (*b*) individual selection.

11. "Mass selection" has been effectively applied by farmers to the improvement of their crops. It must be continuous and uninterrupted.

12. "Individual selection" is more complicated, and requires elaborate records and trials for its successful application.

13. The introduction and acclimatization of certain foreign varieties is likely to lead to valuable direct and indirect results.

14. New varieties may also be obtained by cross-breeding.

15. The immediate effects of cross-breeding in wheats are (1) increase in vigour of progeny, (2) a "breaking of type."

16. Mendel showed that the variations induced by crossing follow definite laws.

17. Mendel's results have been generally confirmed by workers in widely different fields of inquiry.

18. The mode of inheritance of many unit characters in wheat have been worked out in detail.

19. The mode of inheritance of other characteristics in wheat of great practical importance has not yet been worked out.

20. The well informed wheat improver may enter on his task of wheat improvement without leaving much to chance.

(*To be continued*).

SOME VINTAGE CONSIDERATIONS.

F. de Castella, Government Viticulturist.

In view of the near approach of vintage it may be useful to briefly review the developments which have taken place within the last two years in connexion with the wine-making method described in the *Journal of Agriculture* for January, 1911, under the name of "Sulphiting," as well as with a few other points of interest to wine-makers at this time of year.

Such a review must be mainly confined to the newer wine-making developments; nevertheless passing reference to a couple of points, the importance of which has long been recognised, may here be permitted.

Temperature control has, it is gratifying to note, sufficiently established itself as an essential feature of the wine-making of Northern Victoria for further advocacy of it to be superfluous. In Southern Europe 95 deg. F. is looked upon as the critical fermentation temperature *which must not be exceeded if a sound wine is desired.* The higher gravity of our musts makes rapid and complete fermentation more difficult to realize; hence we may with advantage, fix our temperature limit a few degrees lower.

The correction of deficient acidity has not received nearly so much attention as the previous point. It is to be regretted that it is overlooked in too many of our cellars; hence it is well to once more call attention to the powerful influence for good exercised by an adequate proportion of fixed acid in the fermenting must. It is true that sulphiting is capable of replacing acid correction to a considerable extent—in the case of the soft, full-bodied wines required from us in London, this is a feature of sulphiting which is strongly in its favour—nevertheless it is well to remember that should the acidity of the must fall below, say, 6 per thousand of tartaric acid (an exact limit cannot be arbitrarily fixed), fermentation troubles may be expected, and it will be well to increase the acidity, either by direct addition of tartaric acid, or by blending in a sufficient proportion of more acid grapes.

Concerning pure yeasts, there is little to add to what was written on the subject in this journal two years ago, unless it be that their use continues to make headway in Europe, and that increased attention to the question in Victoria would, undoubtedly, prove to the advantage of our wine industry.

Sulphiting.

Since the date of the article on this subject, referred to above, the method has been even more extensively applied in Europe: as *Ventre* wrote recently*:—" To-day the process known under the name of Sulphiting tends to become general, and one can, without much risk, foresee the day when there will not be a single litre of ordinary wine made in France which has not been sulphited." It has also been extensively practised in Australia, with very generally satisfactory results during the past two vintages.

Though there is, perhaps, not much to be added to what was written concerning this new wine-making method two years ago, a few points may, with advantage, be more emphatically stated, especially since some misconception appears to have arisen in the minds of certain practical wine-makers in connexion with one or other of them.

Early Sulphiting Essential.

In conversation with some practical wine-makers, the writer has found that sulphiting has been looked upon by them as a substitute for temperature control, the bisulphite of potash being only added when the contents of the vat had become undesirably hot. If applied in this way the best results cannot be expected from the process. No doubt, temperature control is assisted, owing to the delay in the start of fermentation, as well as to restraint in its early stages; but it is in the selective action of the SO_2 on ferment organisms that the main benefits are to be looked for, and unless it be added from the very moment the grapes are crushed this cannot be depended upon. In other words, the SO_2 must be present in the crushed grapes before the incubation of the latent forms of the various detrimental ferments can take place. Gimel goes so far as to consider it advisable to dissolve the bisulphite before adding it. In his opinion, the delay which must occur before it can be dissolved would permit an undesirable development of injurious organisms. This objection might, no doubt, apply if the addition of the bisulphite were delayed until the vat was filled. It can be obviated by adding the necessary dose for the whole vat progressively, in small portions at a time from the start of the crushing of the grapes. The solution of the bisulphite and its even distribution through the crushed mass must be ensured by frequent stirring or occasional pumping of the juice from the bottom of the vat and its distribution over the mass. Sulphiting, no doubt, assists in temperature control, and has recently been described as "chemical cooling by retardation of the rate of fermentation,"* its action in this direction is quite insufficient in warm weather when loss of heat by natural causes (radiation and conductivity) is slight. Sulphiting cannot thus replace cooling. A serious objection to late additions of SO_2 is that they tend to interfere with the last stages of fermentation, thus making it more difficult for high gravity musts to ferment out dry. With early addition, on the other hand, this objection does not apply. Wines sulphited early are not only sounder, but also drier than those made according to older methods.

* *Progres Agricole*, 18th August 1912.

† Recent developments in wine making methods—de Castella and Wilkinson—Australasian Association for Advancement of Science, Melbourne, 1913.

Different Forms of SO_2 and Dose to be Used.

The forms previously recommended are still those in vogue, namely, gaseous SO_2, bisulphite of potash, liquified sulphur dioxide, commercial sulphurous acid (SO_2 dissolved in water) and sulpho-phosphate of ammonia. In addition to this last proprietary compound, others of somewhat similar nature have been placed on the market in France recently. One in particular, known as "bio-sulfite," consisting of a solution of glycero-phosphate of ammonia in sulphurous acid, is rather highly spoken of. Gaseous sulphurous acid, resulting from the combustion of sulphur, need scarcely be mentioned here owing to the difficulty of regulating the dose. In France, though bisulphite of potash is still very largely used, liquified sulphur dioxide is tending to displace it, since it is cheaper and equally convenient, now that ingenious measuring devices are obtainable. These, however, have not yet found their way to Australia, and for the present it will be well to use bisulphite of potash. The standard dose is still the same as what was previously mentioned, viz., 3 to 4¼ oz. per 100 gallons of wine expected.

Bisulphite of potash,* containing as it does about half its weight of potash, necessarily neutralizes some of the tartaric acid of the grape. It is true that *Ventre* considers this slight loss of tartaric acid to be more than made up for in other directions, chiefly the protection from destruction of several other acids. Nevertheless, seeing the general deficiency of tartaric acid in Australian grapes, it is logical to add at least a sufficiency of tartaric acid to neutralize the potash of the bisulphite. This is theoretically 79 per cent. of the weight of bisulphite added. Wine-makers will, however, find it more simple to add an equal weight of tartaric acid to that of bisulphite employed. French legislation limits the quantity of bisulphite, which may be used, to 3 oz. per 100 gallons (20 grammes per hecto-litre), though there is no limit to the dose of sulphur-dioxide.

Need for Aeration.

As has already been pointed out in the article on Sulphiting referred to, aeration during fermentation is necessary in order to obviate the danger of formation of hydrogen sulphide, traces of which communicate a characteristic disagreeable taste to the wine. Such an accident, due to the reducing action of the yeast on the sulphurous acid, though of rare occurrence, has sometimes happened in Victorian cellars during the past two years since sulphiting has been largely practised. It can be entirely obviated by occasional aeration, especially during the early stages of fermentation. The mechanically driven pumps so extensively used in Northern Victorian wineries, during the vatting of red wines, provide ample aeration. If these are not employed, the fermenting mass must be aerated in some other way—more especially in the case of white wine, which is fermented apart from the skins, must careful attention be paid to this point.

* The salt known as bisulphite of potash and also as meta-bisulphite of potash is in reality a pyro-sulphite, the formula of which is $K_2S_2O_5$. Theoretically it contains 57.6 per cent. of SO_2, but owing to oxidation and formation of sulphate of potash at the expense of the sulphurous acid, it generally contains between 50 and 52 per cent. of SO_2.

A simple and efficient aerating appliance can be easily improvised at the cost of a few shillings by any vine-grower. The only apparatus required is a bicycle or motor pump (foot type preferred), a copper tube sufficiently long to reach to the bottom of the vat, terminated at the lower end by a rose perforated with small holes to divide the air bubbles, and a piece of flexible rubber hose to connect the two. The air may with advantage be sterilized by pumping it through a cotton wool filter consisting of a tin tube of 2 or 3 inches in diameter, and 12 inches long, with fittings to connect with the rubber hose on each end. With such an appliance (with or without filter) air can easily be blown through the fermenting mass. In the case of red grapes, the copper tube should be inserted in turn in different parts of the vat so that the aeration may reach all parts of it. In the case of white wine it is only necessary to stir the tube about while the air is being pumped through. Ten minutes aeration applied in this way to each vat, twice a day for the first four or five days of fermentation, will absolutely prevent any taste of sulphuretted hydrogen.

SETTLING OR "DEBOURBAGE."

This method of making white wine, which has been fully described in the translation of *Roos'* "Wine-making in Hot Climates," page 169, is strongly recommended. Briefly described, it consists in allowing the sulphited must to settle for a few hours before the commencement of fermentation, the check given by the sulphurous acid enabling this to be done. The almost clear must is separated both from sediment and from surface scum, by racking through a tap situated about 8 inches above the bottom of the settling vat, into another vat where fermentation is allowed to proceed. Four and a half ounces of bisulphite of potash to the 100 gallons will check fermentation sufficiently to allow the settling method to be carried out.

VINERIE SYSTEM.

This wine-making method, which promises great extension in France and especially in Algeria, must be briefly referred to here. It is the direct outcome of sulphiting, and consists in sterilizing the crushed grapes before any fermentation has been able to develop, with a heavy dose of sulphurous acid, usually 1 per 1,000 of the weight of the crushed grapes or must; in other words, six to ten times as much as is used in ordinary sulphiting. The sterilized grapes may then be stored until such time as they may be conveniently fermented. In hot climates the advantage thus presented of postponing fermentation until such times as temperatures are favorable is obvious.

When fermentation is decided upon, SO_2 is removed by the process known as desulphiting, carried out in partial vacuum and at a temperature of about 155 degs. Fahr., in a column working on much the same principle as the rectifying column of a still. Though full details cannot here be given, it is evident that slight modifications of this method could, with advantage, be applied by our northern growers. In the case, for example of exceptionally hot weather,

the grapes then picked might be prevented from fermentation by means of a treble does of bisulphite, until conditions became more favorable, when blending with twice the weight of fresh grapes would reduce the dose to a normal one, and enable fermentation to proceed.

Likewise, in the case of grapes carted from a distance, these could be crushed and sterilized with a heavy dose of bisulphite which would be subsequently reduced by " blending in " fresh grapes in sufficient quantity for fermentation to take place. The possibilities in such directions are obvious, and it is hoped that these few points may prove of service during the coming vintage.

PHOSPHATE OF AMMONIA.

The stimulation of yeasts by the use of small quantities of phosphate of ammonia was dealt with at some length in an article which appeared in this journal.* Since then, the process has been fairly extensively used in Northern Victoria, often with excellent results, though not invariably so. The most general cause of disappointment has been the too tardy addition of the stimulant. Some winemakers have only added it so late that the yeast had lost its vitality to such an extent that it could no longer respond to stimulation.

Several French authors go so far as to recommend its addition at the commencement of fermentation, hence the invention of such substances as the sulpho-phosphate and bio-sulphate already referred to. It is, however, to be feared that in warm climates such as this, such early addition would unduly stimulate the first start of fermentation and accentuate temperature troubles. It would appear more logical to add the phosphate of ammonia when racking the vat, should appearances lead one to anticipate deficient attenuation,† to use a brewing term. If not needed, in order to ensure the wine fermenting out dry, the phosphate is not only unnecessary, but undesirable; an excess of it might even serve as a food for other organisms than yeast. If, however, it be added whilst fermentation is still active, and in moderate quantity it is entirely eliminated, being consumed by the yeast plant. *Astruc* has proved that heavy applications are undoubtedly undesirable; but if used at the rate of from 1½ to 4¼ ozs. per 100 gallons. no such results are to be feared.

There are several phosphates of ammonia; the two most common being bi-basic and mono-basic phosphate. The former contains 53.78 per cent. of phosphoric acid and 25.75 per cent. of ammonia. The latter contains 61.72 per cent. of phosphoric acid, and 14.78 of ammonia. The yeast plant requires two and a half times as much nitrogen as phosphoric acid, so that even the bi-basic phosphate supplies too much phosphoric acid, and not enough ammonia. The excess of phosphoric acid appears, however, to be of little consequence, and the last-named salt is the one to which preference should be given.

* *Journal of the Department of Agriculture for Victoria*, April, 1909

† By attenuation is understood the reduction in gravity, owing to disappearance of sugar; or, in common cellar language, the degree of dryness attained.

Tannin.

The use of tannin is not so general in Australian wine-making as in that of most European countries. It is often used, no doubt, in our cellars in the after-treatment of wine, but it is to its value *during the making of the wine* that attention must here be drawn.

Though usually present in abundance in our red wines, it is frequently deficient in our white wines, and it is in the making of these that its more extensive use is recommended.

Tannin, as is well known, precipitates various substances, such as albuminous matter, the elimination of which improves the wine, especially as regards its power of maintaining good, bright condition afterwards. It also has a restraining influence on the development of several injurious micro-organisms.

Many of our practical growers have acquired the habit of allowing fermentation of white wines to commence on the skins. No doubt, soundness is ensured and tannin poverty corrected, but at the expense of the colour and delicacy of the resulting wine. Far superior dry white wines will always be made by immediate pressing and fermentation entirely apart from the skins. In Europe sufficiency of tannin is ensured by energetic pressing such as is not usually practised in Australia, the marc being forked at least once and "cut" a couple of times, before it leaves the press. A similar result is secured by the artificial addition of tannin which is expressly permitted by our pure wine legislation. The addition of ¾ oz. to 1 oz. of tannin per 100 gallons of must will greatly improve the condition of the resulting wine. Some authorities recommend that the addition be only made after the first rush of the fermentation is over in order to avoid loss through absorption by yeast. Others prefer to add it from the start. If settling (*debourbage*) be practised, it is well to follow the latter course, the settling being more rapid and thorough owing to the precipitation of albuminous substances.

In the case of faulty grapes, damaged by moulds, insect pests, &c., the dose of tannin can with advantage be doubled, and 1½ and even 2 ozs. per 100 gallons of must may be added. In this case early addition is certainly to be preferred.

Tannin may be added directly to the must, but, owing to it being rather difficult to mix, it is preferable to first dissolve it in a little weak spirit.

ANNUAL GRANT TO AGRICULTURAL SOCIETIES.

SUBSIDY CONDITIONS FOR 1913.

CONDITION A.—COMPULSORY.

The awards of prizes in all classes for stallions three years old and over at the Society's Show must be subject to the possession by the exhibit of a Government certificate of soundness.

Stallion Inspection Parades will be held at different centres throughout the State prior to the commencement of the Show season (Time Table of Stallion Parades for 1913 will be available shortly after 1st April, 1913). The parade centres are so arranged that all owners of Show stallions have the opportunity of submitting them for examination for the Government Certificate of Soundness before the closing of entries for the Show. Show Secretaries will require to obtain evidence of the possession of the Government Certificate in respect of exhibits at the time of entry, and should not accept entries of other than certificated horses.

Immediately after the Show, Secretaries of Societies are required to forward the names *of all the horses* that have won the prizes in stallion classes, together with the names of the owners, to the Director of Agriculture.

CONDITION B.—OPTIONAL

Agricultural Classes

A sum of £10 as a special subsidy will be added to the *pro ratâ* grant to such Societies as carry out agricultural classes in strict conformity with the following conditions and to the satisfaction of the Department:—

Applications must be submitted not later than 15th March, 1913.

Thirty students at least must be enrolled before a class can be held.

The rent of hall and all local charges are to be paid by the Agricultural Society; all other expenses by the Department. Arrangements must be made to insure the uninterrupted use of the hall during the time the lectures are going on.

A roll of attendances at lectures and demonstrations shall be kept.

The agricultural classes will extend over two weeks, five days a week, a demonstration being given each morning and afternoon, and four limelight lectures on evenings to be arranged for by the Secretary of each Society.

At the conclusion of each class, a written examination of about 1½ hours duration will be held, a medal to be awarded by the Department to the student in each district obtaining the highest number of marks for examination work and regular attendance combined. Two-thirds of the maximum marks obtainable will be given for examination work, and one-third for regular attendance. The Department reserves the right to withdraw the offer of the medals in the event of there being less than five students remaining for examination. Students in attendance at Agricultural High Schools and Colleges, or at the Continuation Schools, and teachers from such institutions or State Schools shall not be allowed to sit for such examination.

A special examination for the Gold Medal offered by the Australian Natives' Association will be held at the close of the year, and only winners of Departmental medals will be eligible to compete thereat.

Subjects of First Week.

Agriculture.
Live Stock and Veterinary Science.

Subjects of Second Week.

Two or more of the following, to be selected:—(*a*) Sheep Breeding and Management (including Wool Classing and Lambs for Export); (*b*) Dairy Farming (including Management and Breeding of Pigs); (*c*) Poultry Breeding and Management; (*d*) Orchard and Garden Work.

Condition C—optional.

LECTURES.

A sum of £5 as a special subsidy will be added to the *pro ratâ* grant to such Societies as arrange for and carry out a series of four lectures throughout the year in strict conformity with the following conditions and to the satisfaction of the Department:—

Applications must be submitted not later than 15th March, 1913, and accompanying the application must be a list of the subjects (see below) which the Society chooses for the series. The dates of lectures will then be fixed by the Department, and if Societies will state the most suitable seasons for their districts the lectures will, as far as possible, be arranged accordingly.

An attendance of at least fifteen *bonâ fide* farmers, farmers' sons or farm-hands will be required, otherwise the lecture will not count for the special subsidy. In case of failure to secure such attendance another lecture will not be substituted, nor will any subsequent lectures that may have been arranged be given.

The President or Secretary or a member of the Council or Committee of the Society must take the chair at each lecture and must certify as to the number and *bona fides* of the attendance as above required.

The rent of the hall, advertising and all other local charges are to be paid by the Agricultural Society; all other expenses by the Department.

The Department will recognise any suitable lecture, paper, or address that a Society may arrange to have delivered by any person other than a Departmental officer, and such lecture will count as one of the four required, provided due notification prior to delivery of lecture is given, and the President of the Society afterwards certifies as to *bona fides* and suitability of the lecture and the number and character of the attendance.

SYNOPSIS OF LECTURES AND DEMONSTRATIONS.

PRINCIPLES OF AGRICULTURE.

1. The plant food of the soil.
2. Cultivation methods and management.
3. Principles of manuring.
4. Valuation of artificial manures.
5. The management of the farm.
6. Special crops and catch crops.
7. Irrigation principles and methods.

Veterinary Science and Live Stock Subjects.

1. The structure and care of the horse's foot (lantern).
2. Brood mares and breeding mishaps (lantern).
3. Colic, constipation, and other bowel complaints.
4. Ailments of dairy cows—milk fever, impaction, udder complaints.
5. Contagious diseases of stock—abortion, blackleg, tuberculosis, anthrax, pleuro pneumonia, &c. (lantern.)
6. Ailments of swine, or ailments of sheep.
7. Unsoundness in horses (lantern).
8. Principles of stock breeding—stud horses (lantern).

Dairy Farming.

1. Breeding and management.
2. Dairy buildings.
3. Dairy management.
4. Milk and cream testing.
5. Foods and feeding.
6. Pig breeding, feeding, and management.

Poultry Breeding and Management.

1. The poultry industry: its importance. Locality—suitability or otherwise.
2. Housing (construction of, materials, insect proof, aspect, &c.). How to select stock.
3. Breeds: payable or otherwise, eggs and table. Breeds adapted for export—modes of crossing.
4. Turkeys: their care and management. Chicken raising and care.
5. Foods and feeding demonstrated.
6. Common ailments of poultry. Incubation—natural and artificial.

Orchard and Garden Work.

1. Fruit growing—Varieties suitable to the different localities, soils and sites.
2. Preparation of land—Planting and pruning.
3. Cultivation—Manuring and management.
4. Insect pests and fungus diseases and their treatment.

Viticulture.

1. Establishment of Vineyard.
2. Phylloxera and resistant stocks—Preparation of land.
3. Propagation and grafting—Best varieties to grow.
4. Pruning and seasonable operations.
5. Wine-making and cellar management.
6. Drying raisins, sultanas and currants—Packing fresh grapes for export.
7. Vine diseases and treatment.

Potato Culture.

1. The soil and its cultivation—Care of the growing crop, manures
2. Seed and its selection—Keeping of seed potatoes.
3. Diseases and their treatment.

SUBJECTS AND STAFF.

Principles of Agriculture—Mr. A. E. V. Richardson, M.A., B.Sc.; Dr. J. W. Paterson, Ph.D., B.Sc.; and Mr. Temple Smith.

Veterinary Science, Stock Management, Dairy Sanitation and Education—Messrs. Robertson, B. V.Sc.; Kendall, B. V.Sc.; Griffin, M.R.C.V.S.; Cother, G.M.V.C.; Johnstone, B. V.Sc.; and Heslop, L. V.Sc.

Dairy Farming—Mr. R. T. Archer and staff of Dairy Supervisors.

The Dairying Industry and Export Trade—Messrs. Crowe and Carroll.

Orchard and Garden Work—Messrs. Carmody, Davey, and Pescott.

Sheep Breeding and Management—

Viticulture—Mr. F. de Castella.

Flax Culture and Demonstrations at Shows—Mr. Robilliard.

Poultry Breeding and Management—Mr. H. V Hawkins.

Poultry Dressing Demonstrations—Mr. A. Hart.

Potato Culture—Mr. G. Seymour.

Tobacco Culture—Mr. Temple Smith.

Pig Breeding and Management—Mr. R. T. Archer.

Fruit Industries—Mr. J. G. Turner and staff.

Insect Pests—Mr. C. French, Junr.

Plant Diseases—Mr. W. Laidlaw, B.Sc., and Mr. C C. Brittlebank.

Irrigation—Expert of State Rivers and Water Supply Commission

Apiculture Mr. F. R. Beuhne.

HUMUS IN THE WHEAT AREAS.

Speaking at the Twenty-fourth Annual Congress of the Agricultural Bureau of South Australia, Professor Lowrie said: "It used to be argued that if plenty of phosphates were put on the land, such a wealth of herbage would result that the organic matter or humus would be kept up. That, however, has not proved to be the case with the man who fallows clean. When the crop is cut for hay the question of supplying humus is not a difficult one. The stubble can be ploughed and worked down, and a crop sown for feed. It may be barley, oats, rape and mustard, peas, and in some districts Italian rye grass. If the tractors which are being introduced will enable the farmer to plough, work up, and prepare for sowing about 15 or 20 acres a day, they are the implements which South Australian conditions require. These would enable the farmers to go over the stubbles at the same time that the teams are sowing the fallows. If the fallowing is done too late there is not the addition of organic matter to the soil. Rape can be sown at the rate of 3 to 5 lbs. per acre, with 2 or 3 lbs. of mustard. If they are sown on stubble the land should be worked and manured well. For fattening lambs I find mustard with rape will avoid risk of deaths. In districts with a good rainfall Italian rye grass and peas should certainly be tried." Where the crop is stripped instead of cut for hay, the problem of growing sheep feed is admittedly difficult unless the stubble is first burnt off.

WHEAT GORGE IN HORSES.

By R. N. Johnstone, B. V.Sc. (Veterinary Staff).

In those parts of the State where wheat is grown farmers frequently experience at harvest time a considerable amount of trouble and loss due to horses gaining access to wheat and gorging themselves. The result is usually an attack of wheat colic or gripes which often ends fatally, or brings on an attack of laminitis or founder, which, so far as the farmer is concerned, is frequently as bad as, if not worse, than the death of the animal. The horses affected are generally valuable working draughts, and the trouble occurs when they can least be spared from work on the farm. Access to wheat is, as a rule, accidental, a gate is inadvertently left open, or a fence is broken down, and usually more than one horse is affected. The symptoms vary according to (1) the amount of wheat eaten, (2) the presence or absence of other food in the stomach, (3) the breed and temperament of the animal affected. Sometimes symptoms are very slight, the horse looks dull and uneasy, is "off his feed," and has occasional slight attacks of pain, causing him to stamp his feet, or kick at his abdomen. In other cases, the colicky symptoms are much more pronounced, the horse is extremely restless, lies down, rolls, gets up again, and walks around as if in intense pain. This may go from bad to worse, the animal may throw itself down violently, roll over and over, jump up, whirl about, drop down again, paw, or strike with the front feet, steam and sweat, and be so violent that it is dangerous to approach close enough to render aid, the breathing is laboured, the membrane of the eyes, nostrils, and mouth assume a yellow colour, and frequently the animal sits up on his haunches like a dog. In some cases the animal attempts to vomit as shown when the upper lip is turned up, and the head is drawn in to the chest arching the neck, or is held outwards and downwards, stretching the neck to its full extent, the throat moves, and the flank heaves violently. Gas may then escape from the nostrils, followed sometimes by a sour smelling froth, and occasionally by stomach contents. Owing to the position and construction of the stomach the horse cannot vomit except when the stomach is so full that its walls become violently stretched, and if the accumulation of food or gas is sufficient to stretch the stomach so that vomiting is possible it may be great enough to rupture that organ. When this occurs colicky pains as a rule cease suddenly, the animal remains quiet, trembles all over, the face has a haggard expression, and death soon ends the scene. For some time, practising veterinary surgeons and others held varying ideas about the treatment of these cases, some declaring that if the animal got a drink of water after overfeeding on wheat, the result was invariably fatal, the reason given being that water swelled the wheat in the stomach, and caused rupture of that organ, while others declared that water was beneficial in these cases, that if the animal would not drink water it should be forcibly administered in large quantities. A horse secretes and swallows about six gallons of

saliva daily, and this, together with the digestive juices met with in the stomach, will swell the grain to its utmost extent. Water when swallowed by a horse does not all remain in the stomach, the greater quantity of it passes directly on to the cæcum or water gut. If taken immediately after the grain has been eaten water will practically wash some of the undigested grain out of the stomach, and so relieve the pressure in that organ. Experiments carried out by Dr. W. T. Kendall at the Veterinary Research Institute have proved that in the majority of cases death is due to a poison which is formed by the wheat while in the stomach of the horse. It has been found that this poison is formed only in the presence of the acid digestive juices of the stomach, and that if some alkaline substance—such as bicarbonate of soda (baking soda)—is administered, thus rendering the stomach contents alkaline, formation of the poison ceases. Therefore, the most advisable treatment is to administer bicarbonate of soda in large doses, about 4 ounces in a quart of water as a drench, or if the animal is thirsty and will drink from a stable bucket, add the soda to a gallon of water. This prevents the formation of poison for a time, but it also stimulates the secretion of the acid digestive juices so that in time the contents of the stomach will again become acid, and the formation of poison will proceed as before. Therefore it is necessary that the wheat should be removed from the stomach as soon as possible. That can be encouraged by a liberal supply of water. Purgatives, such as aloes or linseed oil, take so long to bring about purgation in the horse that in most cases they are useless, and as they also nauseate the animal, and tend to bring about attempts at vomiting, thus increasing the danger of rupture of the stomach, they are to be avoided. The man who is not within reach of a veterinarian must administer another dose of bicarbonate of soda if the colicky symptoms return. Water is beneficial in all cases, as it dilutes the poison and washes it out of the stomach, so the animal should be allowed as much water as it will drink with bicarbonate of soda added. While many animals will recover without treatment of any kind, it is not advisable to postpone treatment until dangerous symptoms set in. On the other hand, excessive administration of drugs should be avoided. Many owners are too ready to pour all sorts of drugs down a horse's throat, and frequently do more harm than good. All food should be withheld until colicky symptoms cease, and for the next few days light, easily digested food such as bran mashes and green fodder, if obtainable, should be given. The horse should not be returned to work too early. An overfeed of wheat frequently gives rise to an attack of laminitis (founder) the nature and treatment of which affection will be dealt with in a subsequent article.

MANURES AND MANURES ACTS.

By Will. C. Robertson, Agricultural Chemist's Staff.

During the years 1904-11 the number of farmers using artificial fertilizers in Victoria increased from 20,167 in 1904 to **27,845** in 1911—an increase of 33.1 per cent.

Forty-five thousand nine hundred and forty tons of artificial manures were sown on 1,521,946 acres in 1904, whilst 86,316 tons were placed on 2,714,854 acres in 1910-11.*

These figures give an increase of **87.9** per cent. in manures consumed over a period of six years.

An approximate valuation of the artificial fertilizers purchased by the farmer in 1911 amounts to £350,000—this fact in itself is sufficient to justify the small outlay involved in the system of inspection adopted by the Chemist for Agriculture in Victoria.

Incidentally it might be remarked that this expenditure does not amount to 1d. per ton of artificial manure consumed.

In certain countries the manufacturers of artificial fertilizers are taxed, to the extent of one or two pence per ton of manure produced, to defray the cost of inspection and analyses, but in Victoria no such tax exists.

Artificial manures, especially of late years, have played an important part in Victoria's annual production, and are destined to become still more prominent in the future.

This paper deals mainly with the inspection of artificial manures in the State of Victoria during the past twelve months, together with a general review of the past eight years' work.

Although the great importance of artificial manures is readily admitted by the farming community, the surprising fact remains that a large percentage of Victorian farmers are very hazy in their knowledge of the composition and functions of the various manures on the market.

The Victorian farmer labours under sufficient disadvantages without adding another to the list. The price of land is on the upgrade, wages on the increase, machinery dearer, and, last but not least, the price of artificial fertilizers has an upward tendency.

In the latter respect the following "Graphs" will be of interest:—

No. 1 depicts the rise in the price of the nitrogen unit (*i.e.*, 1 per cent. of nitrogen) during the years 1905-1913 inclusive.

The figures on the sides of the diagram denote pence. It will be noted that the potash unit has remained fairly constant, but a unit value has been plotted this year for the potash in potassium nitrate, and this figure shows a remarkable increase.†

The nitrogen figures are particularly interesting—the units of all forms are considerably higher, and that for dried blood shows an increase from 11s. in 1905 to 15s. 9d. in 1913.

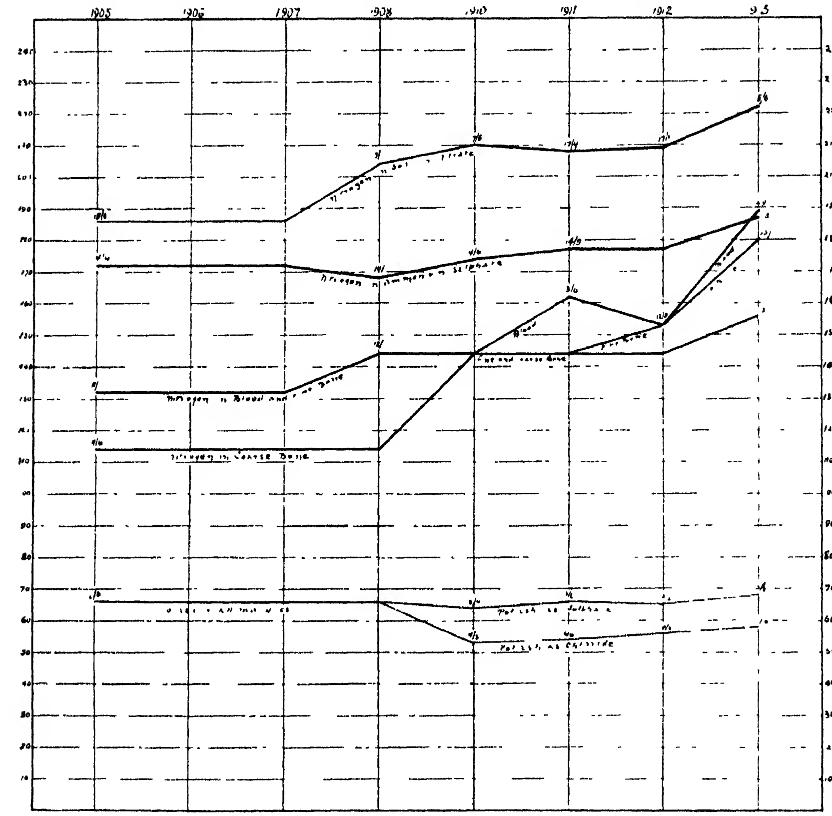
A rise in nitrogen values has been prophesied for many years past, but when the theory of "fixing" the nitrogen of the atmosphere

* Statistical Register of State of Victoria 1910.
† See *Journal of Agriculture*, Victoria, 1913, p. 18

terminated in fact, and calcium cyanamide and nitrate made their advent, the fear was to an extent dispelled.

However, as the values for nitrogen show a marked increase in the face of the artificial fixation of the nitrogen in the atmosphere, and the utilization of the compounds so produced, the policy of nitrogen conservation on the farm requires more than passing attention.

Graph No. 2 sets out, firstly, the number of pounds of phosphoric acid and nitrogen received by the farmer for every twenty shillings spent in the purchase of bonedust during the years 1906-13, and,



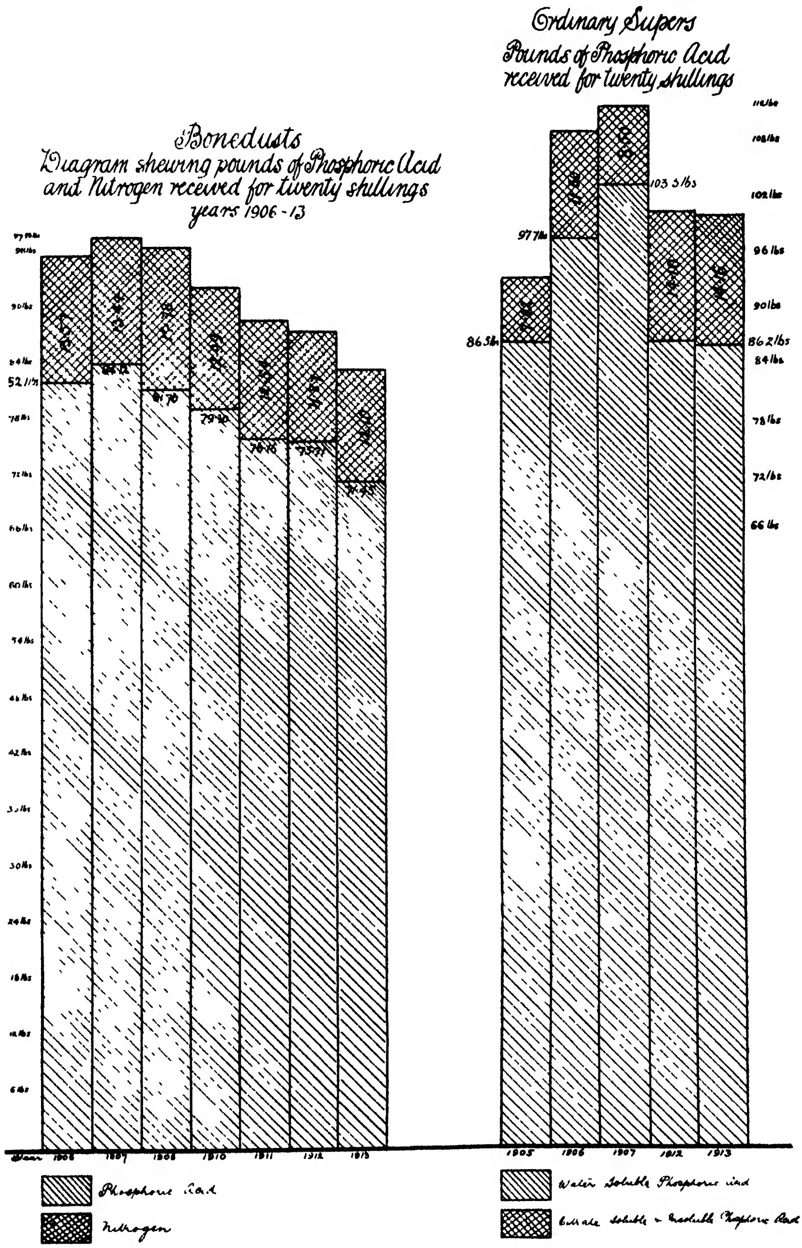
Graph 1.

Showing the rise in the price of the nitrogen unit (*i.e.*, 1 per cent. of nitrogen) during years 1905-13 inclusive.

secondly, the number of pounds of water soluble phosphoric acid, and other forms obtained for twenty shillings when purchasing superphosphate in the years 1905-06-07-12-13.

As explained by the key at the foot of the graph, the "one-way" shading in the case of bonedusts denotes pounds of phosphoric acid—the figure being given at the top of each column. The cross shading denotes pounds of nitrogen, the correct figure for which is placed in the shading.

The figures on the side are the scale of pounds, whilst the figures at the foot show the year.



GRAPH 2.

(1) Shewing the number of pounds of phosphoric acid and nitrogen received by the farmer for every 20/- spent in the purchase of bone dust during years 1906/13.

(2) Number of pounds of water soluble phosphoric acid, and other forms obtained for 20/- when purchasing super-phosphate in the years 1905, 1906, 1907, 1912, 1913.

In the case of ordinary supers. (right-handed diagram), the "one-way" shading stands for pounds of water soluble phosphoric acid—the other forms being denoted by the cross shading on the top of the column.

Since the year 1907 there has been a gradual decline in the average composition of bonedusts, together with an increase in the price per ton.

To put this in a nutshell, a ton of bonedust which cost the farmer £5 8s. 3d. in 1906 is costing him £6 3s. in 1913—an increase in price of **13.60** per cent.

Referring to the other side of the "Graph," it will be noted that "other forms" of phosphoric acid show a marked increase in the composition of ordinary "supers," and this at the expense of the more valuable water soluble material. This is solely due to the admixture of insoluble rock phosphate, which serves the double purpose of acting as a "drier," and building up the content of total phosphoric acid, so as to minimize the decrease in the water soluble content.

During the years 1906-07, the appearance of a new firm on the scene of operations, and the resulting competition, sent up the quality of "supers," and caused a fall in price. Unfortunately for the farmer, this state of affairs soon balanced, and to-day he pays approximately the same price for his superphosphate as he did in 1905.

The following table sets out the prices of the various artificial manures at Home and abroad.

The prices marked with an asterisk are taken from *Fertilizers*, August, September, October, 1912, and although they may be wholesale prices, the fact cannot be disguised that the local farmer pays a much higher rate for his fertilizers than does his friend across the sea.

Prices at Home and Abroad.

Manure	Price per ton abroad	Price per ton in Victoria
Superphosphate ..	£3* per ton on rail (16 % water sol. phos. acid)	£4 7s. 6d. per ton on rail (17 % water sol. phos. acid)
Thomas' Phosphate ..	£2 12 6*	£4 4 6
Rock Phosphate (80 %) ..	£2 16 6*	£5 0 0
Sodium Nitrate ..	£12 0 0*	£13 10 0
Ammonium Sulphate	£14 15 0*	£15 0 0
Bonedust	£6 0 0*	£5 19 7
Kainit	£2 10 0*	£5 0 0
Potash Sulphate ..	£10 11 0*	£14 7 6
Potash Chloride ..	£9 10 0*	£14 5 0

It should be noted that the superphosphate quote is for a 16 per cent. article, whereas the standard sold in Victoria is 17 per cent. This, however, is only a matter of a few shillings per ton.

The producer has to sell his wheat, etc., in the world's markets, and therefore is not empowered to increase his prices—the average price in Victoria for wool, wheat, oats, and live stock (excepting horses) for the last five years shows no appreciable difference. It, therefore, behoves the farmer to learn as much as possible of the high-

priced aids he is dependent upon, so that he may carefully peruse the registered list of the various brands of manure* and intelligently select the brand of the one required, giving him the best and most for his money.

The unit values for the various forms of nitrogen, phosphoric acid, and potash are published annually in the *Agricultural Journal* by the Chemist for Agriculture, together with the method of valuing any manure on its guaranteed analysis.

MANURES ACTS INSPECTION.

Under the heading of "A few Disgraceful Cases of Fraud," Dr. F. J. Howell writes, in the *Agricultural Journal*, page 376, 1903-4—"Although, generally speaking, the samples sent in through the Agricultural Societies were of a high standard, there were a few samples received direct from the farmers which were practically worthless for manurial purposes, and the conclusion must be drawn that, in a certain number of cases at any rate, the farmer in Victoria is being defrauded by unscrupulous vendors. The most flagrant cases of fraud occurred at Tarrawingee, where an article sold as a high grade superphosphate was found to contain only 2.60 per cent. cit. sol. and 3.91 insol. phos. acid."

The value of a manure of this description would be something under £1 per ton.

In 1904, the year following this report, Act No. 1930 was placed on the statute-book, and inspection took place under this Act from 1904-10.

After careful study, the administration of this Act was found to be cumbersome and to have many disadvantages. In 1910, certain sections were repealed, and an amending Act drafted (Act No 2274), and passed by Parliament. At the present time the work of inspection and prosecuting, together with the analyses attached thereto, is conducted under the two Manures Acts, viz., Nos. 1930 and 2274.

One important effect of the amended Act is a decrease in the number of samples collected during the year. This is brought about by a compulsory clause, rendering it imperative for the Chemist for Agriculture to forward the result of the analysis of any given sample to the manufacturer within thirty days. With a limited staff doing a variety of work only a small number of samples can be analyzed monthly.

The prosecutions have been many and varied.

The policy of the Department in the early stages of the administration of the Act was to tender advice and give warnings in all cases of non-compliance detected, thereby enabling the manufacturers and dealers to make themselves acquainted with the new conditions.

In 1907, two firms, who had previously received warning, were prosecuted for not labelling parcels of manure, and in two cases, where manufacturers would persist in selling manure without submitting a true sample to the Chemist for Agriculture, as required by the Act, proceedings were successfully instituted.

* *Journal of Agriculture*, Victoria, January, 1913, p. 18.

From the passing phases, these cases would be termed technical breaches, but in one case, at least, actual fraud was cleverly covered.

In 1908, one or two cases of adulteration made their appearance.

During the year 1909, owing to adulteration becoming prevalent, all violations, where manufacturers or dealers had received previous warning, were proceeded against.

The following table sets out the number of samples collected during the years 1906-12, together with the number of prosecutions and the amount of fines:—

Year	Number of Samples Collected	Number of Prosecutions.	Fines £ s. d.
1906	147	Nil	Nil
1907	129	4	8 6 0
1908	175	2	4 2 0
1909	183	10	39 10 0
1910	131	7	7 10 0
1911	70	4	31 0 0
1912	68	13	28 0 0

During the years 1910-11, prosecutions took place against manufacturers and dealers, mostly under section 5, for not submitting invoice certificates with manure sold, or under section 7 for incorrect labelling.

In each year, however, there was at least one very bad case of adulteration.

During 1912, the season just finished, it is most unsatisfactory to have to report adulteration to be still more prevalent.

A glance at the following table, setting out the percentage of the samples collected during the years under review, which were found to be under guarantee and under the limit allowed by the Act, serve to illustrate:—

Year	Per cent of collected samples found to be adulterated
1906-7	Nil.
1908	·57 per cent.
1909	1·09 ,,
1910	2·30 ,,
1911	5·70 ,,
1912	**10·30** ,,

In the worst case last year the difference in value between the guaranteed manure purchased and the adulterated article supplied amounted to 19s. 8d. per ton, and the marked increase of adulteration shown to exist probably owes its origin to the low penalties provided under the Act.

In the case cited above, the manufacturer has an annual output of approximately 3,000 tons, and it was only a matter of supplying 30

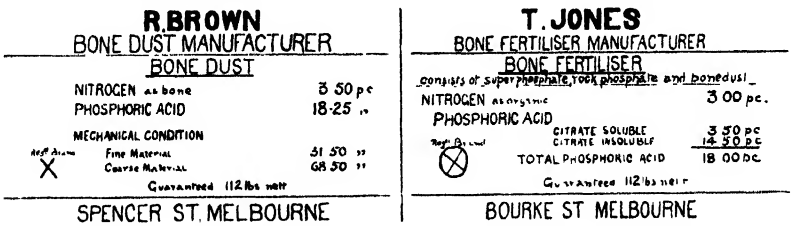
tons of the adulterated manure to cover all expenses, including fine and costs.

One manufacturer who was successfully proceeded against for selling manure under guarantee frankly admitted to the inspecting officer at the time of taking the sample that he had run short of manure, and, rather than disappoint a good customer, he made up the order by mixing with marl. Presumably he considered disappointing his customer a more heinous crime than selling him manure known to be inferior.

In another case, a farmer sent an order to an agent for "bone and super." The agent had none in stock, but, rather than refuse an order, and incidentally to "clean up," he mixed several "butts" (*i.e.*, bags of manure that had been opened) together and sent it off, happy and content, without a guarantee.

In the latter case the farmer may have received the best of the bargain, and yet he may not. At any rate, he bought "a pig in a poke."

All cases of adulteration during season 1912 were in the bonedust, or bone fertilizer section, and it may be reasonable to suppose that this is due to the scarcity of the genuine article—at the same time it must



be said that this is not a fair excuse, and the honest trader should refuse orders rather than run the risk of supplying a substitute.

Bonedust is a most difficult manure to obtain at the present moment, and time and again, during 1912, farmers were met in possession of the manure termed "bone fertilizer," but which they had bought for bonedust.

Always when instances of this nature have come under notice, the attention of the farmer has been drawn to the labels attached to the bags of manure, and the extraordinary explanation has been put forward that the Agricultural Department will not allow manufacturers to sell bonedust, they are compelled to sell "bone fertilizer." This is strictly incorrect.

During the year 1909, research analyses were conducted in the Laboratory on samples of bonedust (?) collected in various parts of the country. The result was the disclosure of the astounding fact that instead of being the product obtained by grinding bones, the majority of the bonedusts (?) on the market were mixed manures, containing very little bone, being principally mixtures of "super" rock phosphate, and meat refuse, or some other organic material supplying nitrogen.

Manufacturers were immediately informed that this mixture could not be sold as bonedust, and they decided to sell it under the name of "bone fertilizer."

A "bone fertilizer" may be—anything; but a bonedust is defined under Act No. 2274 as "a manure consisting only of disintegrated bones, or recent animal matter, and containing over fifteen parts of phosphoric acid in each one hundred parts of the manure."

Bonedusts and bone fertilizers are labelled in a totally different manner, as a glance at the above exhibit will show:—

After perusing the following table, which gives the average composition of the bonedusts and bone fertilizers on the local market at the present moment, together with the price asked and the calculated value of the two articles, the farmer may draw his own conclusions.

COMPARISON BETWEEN BONEDUSTS AND BONE FERTILIZERS.

Manure.	Season	Nitrogen.	Phos. Acid	Price asked	Cal. value.
				£ s. d.	£ s. d.
Bonedust	1912-13	3·31	19·63	6 3 0	6 3 0
Bone Fertilizer ..	1912-13	3·65	16·51	6 1 0	5 2 9

Pure bonedust is becoming scarcer every year, yet there is not the slightest doubt but that a vast tonnage of bones is annually wasted in Victoria.

This will undoubtedly be the case until some system of co-operation on the part of farmers takes place, whereby bone mills are installed in country centres, the raw material being systematically collected around the countryside, and the finished product being sold to the shareholders in each manuring centre at cost price.

Such a scheme would serve the twofold purpose of saving and utilizing most valuable fertilizing material, and at the same time provide farmers with the genuine article.

BONES.

During the year 1910, there were slaughtered in Victoria 249,229 head of bullocks and cows, 70,436 head of calves, 4,245,881 head of sheep and lambs, and 257,287 head of pigs.*

The carcass of a bullock or cow will average approximately 90 lbs. of bones, that of a calf or sheep 10 lbs., whilst that of a pig gives 20 lbs.

Taking these averages, cattle slaughtered in Victoria during 1910 produced 10,328 tons of bones, the sheep and lambs give 18,955 tons, whilst pigs further augment the total by 229.7 tons—not taking into account the bones obtained from the carcasses of dead horses, we obtain a grand total of 29,512 tons of bones.

This tonnage is a fairly accurate estimation of the amount of bones produced during the year under review, and may be taken as a fairly exact estimate of the amount of bones that could be made available for the production of bonedust, and yet the thirty-odd bone mills working in the State placed approximately 7,000 tons at the disposal of the farmer.

* Statistical Register of State of Victoria, 1910.

This works out at 23.72 per cent., and the value of the bones wasted amounts to £135,000.

It may be said that these figures are wrong, in that bones are utilized for other purposes, and, again, the householder does not waste the kitchen bones, but puts them on his vegetable garden.

The reply to the first argument is that the estimate of bones produced allows for the bones used for industrial purposes, whilst, in the second case, bones are wasted when thrown promiscuously on the soil, for they should be sown in the finely-divided condition; furthermore, the majority of kitchen bones are utilized under the copper on washing day, and the ash thrown in the poultry yard.

Review of Samples Collected, 1912.

Of the sixty-eight samples of artificial manure collected in various parts of Victoria during the past year, there were fifteen samples of bone fertilizers, fourteen samples of "bone and super," nine superphosphates, nine bonedusts, whilst the remaining twenty-one consisted of dissolved bones and super, dried blood, Thomas' phosphate, animal fertilizers, nitro-supers, guano, sodium nitrate, blood, bone and super, and mixed manures, such as potato, maize, rape, fodder, grass, and special grain.

The unsatisfactory condition of the bonedusts and bone fertilizers has already been discussed. The "bone and supers," whilst complying with the guarantee, contained samples which were not at all true to name, and in one instance it was very evident, from the casual glance, that the manure contained little or no bonedust, but consisted of rock phosphate and "super."

Farmers would do well to buy bonedust and super separately, and mix the two themselves.

The analyses of the superphosphates collected proved them to be of very high standard, and viewing the manure trade from the superphosphate stand-point there is left little to be desired.

All the samples of the mixed manures, nitro-supers, dried blood, etc., analyzed well up to the guarantee, but the increase in the sale of mixed manures is rather hard to understand, for bold indeed is the scientist who will prescribe, say, a potato manure to exactly suit all soils in Victoria. If the farmer is to obtain any benefit from the small amount of potash or nitrogen, or both, as the case may be, that is contained in any given mixed manure, then it must of necessity be at the expense of a dressing of at least one ton per acre.

Consignments of "Star and super" are met with here and there, and inquiries elicits the information that this "basic" manure is giving good returns on some of the heavier soils.

The samples of "Star and super" collected analyzed well up to the guarantee, but as there is certain to be reversion in mixing star phosphate with superphosphate to produce the manure under discussion, a freshly mixed "star and super" will indubitably be of more value than one that has been mixed some months, or, may be, years.

Under the circumstances, where a farmer is tilling a soil of the type that responds to a dressing of this manure, it would be advisable to buy the two manures separately and mix them on the floor of the barn at the farm.

It is asserted that in no other part of the world is the inspection of artificial manures so stringent as in Victoria! If this be true, then one must look for a reason for the increase in adulteration.

As hereinbefore stated, this adulteration takes place in the bone-dust and "bone fertilizer" section, but the driver of the 'bus sees more than the passenger inside, and there is not the slightest doubt but that the inspection of the artificial manures sold in Victoria will be just as vigorously carried out in the future as it has been in the past.

Providing the elements be kind to the Victorian farmer, and the manure he purchases is the genuine article, life is made easy—at least, his work is lucrative; but no matter how kind the elements are, if the manure he buys be rubbish, a good crop is by no means assured.

Under the circumstances one would think that the farmer would lend all the assistance in his power to help the Department, which has for one of its aims the supervision of the manure traffic, thereby rendering him safe, as far as the quality of the article he purchases and relies upon is concerned, and yet instances are common where the farmer actually stands in the way of the inspecting officer and his duties.

It would be a drastic action indeed if the farmer who had purchased manure was summoned for obstruction, and yet such a course could be, and may be, pursued in future.

To cite one instance of obstruction at the hands of the farmer. This took place last year, and happened over a bonedust transaction. The manufacturer was being proceeded against, and on a sale being traced, the purchaser (a farmer) was written to by the Department and asked for the invoice certificate or warranty obtained with the consignment of manure. The document was required by return post, and fully a month had elapsed from the date of delivery.

No reply was received until after a second letter had been written, and then an informal document was sent along. It subsequently transpired at Court that originally no warranty was received with the manure, but instead of the Department being made aware of the fact, the farmer obtained a guarantee from the manufacturer some time after he had used the manure, and forwarded this document to the Department. This farmer could have been prosecuted.

Farmers are requested to see for themselves that an invoice certificate is submitted at the time of sale, and in all cases to file these documents, in case they be required subsequently as evidence. By so doing they will greatly assist in the administration of the Artificial Manures Acts.

Potatoes are surface feeders, and to ensure an abundant crop liberal manuring is required. A general manure supplying nitrogen, phosphoric acid, and potash will often pay best.

The roots and stubble left by a cereal crop are considerable in amount but poor in nitrogen. The root residues from leguminous crops, clover, vetches, and lucerne are very rich in nitrogen, and form an excellent preparation for a cereal crop.

FARM COMPETITIONS—NHILL, 1912.

By Temple A. J. Smith.

The results of the Nhill Farm Competitions herewith, and opportunity is taken of congratulating the Nhill Agricultural and Pastoral Society on the fact that in this, the twelfth year since the inauguration of the system, the entries total thirty-four, which is, I believe, a record for the whole period, proving that the interest is well sustained, and the system a useful one for various reasons. It is also a high tribute to the energy of the Secretary, who has evidently been unsparing in his efforts to make a success of the undertaking.

The old saying "that competition is the soul of business" evidently applies to farming in this case, and the spirit of emulation induced has in the past, as it must in the future, lead to progressive methods in all branches of the industry. The object lesson set by some of the leading farmers of the district is a valuable one to others, and the opportunity offered so open-heartedly of inspection and discussion on the actual farms themselves must lead to better practices, and, incidentally, better monetary returns, in a district so full of great resources and possibilities.

It is gratifying to find that there are men like Messrs. Dahlenburg, G. and W. Batson, G. Crouch, and others, experimenting in wheats and grasses with a view to the improvement of yields and quality, and, though much of this work is discouraging, some good results have already been achieved, as, for instance, Mr. F. Schultz, who has a fine crop of Viking wheat, asserts that he prefers this variety to Federation, as it gives him better yields and comes away faster, beating the wild oats better; it is early maturing, with a longer straw, but it is liable to shake. Mr. W. Batson grows a wheat known as Defiance, which he claims yields well, does not shake, with a strong, good standing straw. Messrs. Dahlenburg and G. Batson have introduced Melilotus for fodder, and on the latter farm nice little patches of lucerne testify to the possibilities in the future for this crop. Water is, of course, the secret of success for lucerne, but I believe there are great possibilities in the future for irrigation in regard to plots of lucerne, citrus fruits, and other forms of intense culture. Any visitor knowing what is done in other parts of the world is at once impressed with the large sheets of water in the swamps around Nhill. Swamp waters are quickly evaporated owing to their shallow nature, but why should this water not be caught and conserved in dams before reaching the swamp. A series of deep dams, one above the other, would not only catch more water, but would hold it longer, as deep water is not evaporated as fast as shallow, and from the dams it could be brought to the crop by gavitation. Thirty to forty acres of lucerne irrigated would supply an immense amount of fodder in dry times, and be the most practical insurance against drought. The establishment of citrus fruit growing would immediately enhance land values, as would vines for wine and raisin production, and this would apply to some of the now so-called poorer land for wheat growing.

The rotation systems followed were in most cases the same, and I am of opinion that in this respect an improvement can be effected, and I would strongly advise a trial of the following course:—

First year, fallow; second year, oats; third year, fallow; fourth year, wheat, and, as soon as possible, sow rape, rye, and peas.

The reasons for this course are:—

1st That oats always yield better after fallow.
2nd. That oats and fallow rid the land from "take all."
3rd. That wheat follows oats better than oats follow wheat, because oats, being larger root makers, leave a better supply of organic matter decomposing in the soil This means more nitrogen, and more phosphoric acid is released from the soil supply by oats than wheat, consequently bigger wheat yields can be expected.

If rape, rye, and peas were sown in the Autumn, a valuable rotation crop for restoring the soil, and releasing plant foods would be used, and a fine amount of feed for stock be supplied. The mixture gives bigger yields of fodder and a better balance ration than any of these crops sown separately, and as all three of the varieties are recognised useful rotation crops, good resultant effects must ensue. Very few attempts are made to keep up the supply of humus in the soil, and it has been found that land, especially that containing large proportionate quantities of sand, becomes liable to set hard, and loses its capacity for holding moisture, as the percentage of humus decreases, an important feature when dry seasons are experienced.

Seeing that these crops supply more humus through their larger root system as it decays, the effect must be good, and if, after feeding, they were allowed, in the Spring, to grow up to 6 or 7 inches and were then ploughed in, a supply of something like 4 tons of organic matter per acre would be gained. The soil would be more easily worked, and better supplies of nitrogen would result. It is a well known fact that wheat follows peas and vetches well, and bigger yields are reaped. There is also less danger of the land becoming sick, the change of crop being good for the land in this respect.

Crops and General Conditions.

The wheat crops, on the whole, were very much better than expected, and though most of them contained very large quantities of wild oats, they were almost free from disease altogether. Smut was almost an unknown quantity. There was no rust, and only a suspicion of "take all," in the crops inspected. White heads were fairly prevalent, and in patches some were tipped, but these conditions were not general. In the great majority of cases the heads were long, well filled from top to bottom, and it should not be at all surprising if the yield is better than anticipated, the sample of grain should be really good. The favorite variety is "Federation," next to which is Bluey—"Dart's Imperial," other varieties which showed up well being College Purple Straw, Viking, Yandilla King, and Defiance. It is a mistake, in the interests of the district, to confine the growers' attention too much to one variety, especially where there are local flour mills, and I would suggest that the introduction of further varieties, such as Bunyip and Marshall's No. 3, which should do well round Nhill, might be advantageous.

A judicious system of seed selection would probably improve the yield generally, and it is somewhat surprising that more is not done in this direction. The principle is applied as a matter of course in breeding live stock, and there can be no doubt that much can yet be done in regard to grain in the same way. The opinions of the leading men were, as a rule, against dry sowing, and no doubt they are right, as there is a better chance of a crop receiving no check if seeded when the land is in just the right condition; at the same time, if land has been well fallowed and worked to make the right seed bed and conserve moisture, the risk from dry sowing is not so great as is imagined, the worst feature being the possibility of weeds getting too much start, and this can be obviated to a large extent by harrowing after the crops are up—a practice that might be followed to a greater extent by many, the few that have followed this practice being fully satisfied with the results. Though some of the finest crops seen were very late sown, one of them in August, had the season been an early one instead of abnormally late, these crops would have been most unsatisfactory, and a big risk was taken in such late sowing. The amount of seed used, which appeared to give best results, was a bushel, and seeing that the late crops were best, this is explainable, as a man must seed heavily if sowing late. Seeding experiments in the past made by the Department of Agriculture go to show that, on the whole, a bushel gives best results at any time.

Mr. C. H. Towns.

The popular and energetic secretary of the Nhill Agricultural Society to whom the success of the competition is due.

Pickling appears to be done haphazard, and, although no smut worth talking about was seen, more careful methods might be adopted, and a 2 per cent. bluestone solution used (2 lbs. to 10 gallons) being quite strong enough to kill the spores without the risk of injury to the grain.

Drake was fairly plentiful in some of the crops, and in others there was a considerable amount of rubbish in the shape of weeds, these all draw upon the supply of food and moisture that should go to the crops, and are evidence of bad management in the fallow and rotation systems.

Oats.

The oat crops were, with few exceptions, bad, being very dirty, and short, and many crops that would have been better cut for hay were left for stripping. I am firmly of opinion that generally better crops of both oats and wheat would result from the system of fallow oats, fallow wheat, for reasons already given.

A small paddock of Cape barley seen at Kaniva was sufficient proof that this crop can be grown successfully—the yield being about 9 bags per acre, and the sample fine, clean, and plump. Barley is a highly profitable crop, and might be worth more attention, and, though an exhaustive one as compared with other cereals, might come in with a rotation course.

Manurial Notes.

The system of manuring was the same in each place visited on all kinds of soils, and for all purposes. A trial of bonedust on some of the sandy mallee soils might lead to good results, or a mixture of half bone, half super, also, on some of the heavy low land, a trial of Thomas phosphate would be advisable; both of these manures would need to be fairly heavy, the first year, say at the rate of 75 lbs. per acre, after which 50 lbs. per acre should be sufficient; this is due to their slower action in the soil. In both cases the after-effect on native oats and grasses would be of value. A change of manure has a good effect on the soil, too, in a general way. The present growth of natural feed is simply splendid, and this would be cut for grass hay in many dis-

MR. F. C. DAHLENBURG'S HOMESTEAD, 1ST PRIZE BIG FARM.

tricts as a provision against a bad time in the future. At present a large proportion of it is wasted, and is at the same time assisting to dirty the ground for the next crop.

Large Farms.

Mr. F. C. Dahlenburg, for his fine farm "Roseneath," Kiata, takes pride of place in this competition, practically every detail in his farm management being highly praiseworthy. His farm of 2,300 acres would be hard to beat anywhere. The system employed is good in regard to rotation and cultivation. He has also some fine wheat crops, and he does not confine himself to one variety only—his Purple Straw and Darts being very fine. Mr. Dahlenburg pickles with bluestone, and this year also, in one instance, used salt in addition with good results, the crop so pickled being certainly better in appearance than that pickled in the ordinary way. The oat crops, however, were poor. All seed is carefully graded and sown for wheat at the rate of 60 lbs. per acre. Nine hundred acres were under wheat and oats in all.

The fallow was generally good, but rather crusted in some paddocks.

The horses on this farm were particularly good, a fine even lot of good quality, and highly useful. Some of the mares showed exceptionally good quality. The stallion—a two-year-old—was a well furnished horse, showing good promise. Twenty-nine draughts, all in good order, all bay, make a beautiful picture, and are a very fine asset on the farm. Some good foals and two-year-olds coming on were seen to keep up the general status of this class of stock. The buggy horses and ponies were also in good order, and well suited to their work on the farm.

The sheep were also a nice lot, consisting of 800 merino and comebacks, even in quality, fine framed, and in good condition. A nice line of lambs was seen also. Mr. Dahlenburg is contemplating the use of comeback rams, followed by merinos, with a view to preserving size and heavy fleeces. This course is, I think, open to criticism, in that the use of crossbred rams will lead to a want of evenness in both frame and wool.

MR. F. C. DAHLENBURG'S FARM HORSES, 1ST PRIZE BIG FARM.

Cattle are a secondary consideration, but the nine cows seen were a useful mixed lot for dairy purposes.

The pigs were good farm sorts, and were well provided with styes and paddocks.

The fowls, White Leghorns, were good, and also were well housed in buildings which were kept whitewashed and clean.

A few turkeys, Bronzewing, were strutting round, evidently in blissful ignorance of the near approach to Christmas.

The farm equipment was very fine, comprising all that was necessary on a well-conducted holding. The machinery was well kept on the whole, and a credit to the general management.

Fences and gates, also drafting yards, were all in fair to good condition—the place being subdivided into no less than twenty-one paddocks—the water supply being provided with twenty dams, varying in size from 600 to 5,000 yards. Water is laid on to the house, garden, stable, and horse troughs, there being a fine watering trough in the large horse yard a convenient distance from the stable.

The homestead is beautifully situated and designed, being of brick, and containing fourteen rooms. Wide verandahs surround the house, and the whole is lighted by petrol air gas, as is also the stable and buggy shed. The house is beautifully kept, while the garden is perfect. The flower beds, paths, and lawns would be a credit to any town mansion. No less than ninety varieties of roses were seen, while flowers of all kinds were blooming in profusion. The orchard was in splendid order, the trees being good shapes, and the land well cultivated.

The vegetable garden was well stocked and nicely kept.

The outbuildings on this farm are numerous and good. A stable measuring 90 x 40 ft., roomy and high, with a convenient system for chaffcutting and supplying feed. A crusher through which grain is also passed before feeding giving the maximum value for the amount fed. A commodious grain shed, capable of storing 3,000 bags, good machinery, and cowsheds, and smaller buildings—all substantial and well ordered—make the farm look like a small township—a large oat bin on the silo principle being noticeable.

The system of fodder conservation adopted is a good one—a two years' supply ahead being the rule.

Tree planting has been done on a large scale, and natural timber belts reserved for shelter, lending an atmosphere of coolness and comfort, in addition to their practical usefulness.

Insurance is almost a dead letter with Mr. Dahlenburg, who says he prefers to do his own insurancing.

Mr. Geo. Crouch, of Kaniva, runs Mr. Dahlenburg a close second in this competition, and his homestead and buildings, though not on as extensive a scale, were comfortable and useful, and admirably kept. His system of cropping, rotation and cultivation, is practically the same as that generally practised. His farm crops, taken all round, are very fine, being very even so far as his wheat is concerned, and his oats were also better than many of those seen. Mr. Crouch is also experimenting with new varieties of wheat, but has not yet found anything to beat Federation. A small patch of Cape barley was being harvested, and, as previously mentioned, was particularly good. The fallow on this farm was undoubtedly the best seen.

In live stock, Mr. Crouch, although possessing a highly useful lot of horses in good order, does not come up to Mr. Dahlenburg in this respect; at the same time one cannot but be impressed with the care of his stock generally. The horses' feet were kept trimmed, the harness all in its place and in splendid condition, though some of it was twenty years old. The sheep were especially good sorts, very even, large framed, and showing quality. His cattle also were useful, and the pigs fair. A serviceable lot of fowls were running about.

The farm equipment was good, every implement, from the engine to the harrows, being kept in tip-top condition, well housed; ploughs twenty years old were true, and without a rock in them. Wire net doors were placed in front of the machinery sheds, no doubt a disappointment to the fowls, but a considerable advantage to the implements, which were all cleaned up and repaired before putting away for the season.

The fences, gates, and yards are all very good, the sheep yards being the best seen. The stable yard has been raised 12 inches, and was

in beautiful order. In all there were thirty-five paddocks, comprising 3,060 acres, making the subdivision very complete. Water storage is provided by seventeen dams, and water is laid on to the house and other important buildings, being lifted by windmills. Iron tanks are numerous.

The farm buildings reflect great credit for their serviceable nature and condition and general plan, a nice house, built for one son, in addition to the old home, being substantial and comfortable.

The wool shed is roomy and well fitted, stable good and lighted by gas, and other buildings in keeping.

In the orchard and garden sections Mr. Crouch loses points by comparison, the soil round the house being rather unsuitable for garden purposes, though it is the intention to establish a garden on another portion of the property.

The reserve of fodder was well managed and good, but on rather a smaller scale than might be advisable.

Tree planting might also be indulged in to a greater extent. Mr. Crouch insures more extensively than most of the farmers visited.

MR. HOFFMAN'S HOMESTEAD, 1ST PRIZE SMALL FARM.

I cannot conclude the description of this farm without special reference to the splendid general management shown, which is a fine object lesson to any one engaged in similar pursuits. Everything was well thought out and well done, and it will be noticed that in the more important branches of farming Mr. Crouch scores well.

SMALL FARMS.

Mr. Hoffman's farm of 900 acres is well situated, and kept in very nice order. Management is evident throughout. The homestead is well built and in good order, and well laid out. The stables and sheds are good, and everything in them cared for. A fine shelter shed for his cattle, built of bush timber and thatched with straw, struck me as being extremely useful for his cattle in hot weather.

The implements on this farm are well chosen and in good order. The system of cropping is much the same as that generally adopted, namely, fallow, wheat, oats, grass. Mr. Hoffman cuts a quantity of grass hay annually, and speaks highly of its value, the average cut

being half-a-ton per acre. A very nice stack was in course of erection at the time of inspection. The cocky chaff and straw was also not wasted, but carefully stored for use in bad times.

The men's quarters, though small, were neat and comfortable.

Fowl houses and yards were well built, roomy, and well stocked with first-class Leghorns.

The horses were better than are generally seen on small farms, including some fine mares and good foals.

There were no pigs, but, as a rule, a few were kept.

The fences were fair, but more gates would be an improvement. The wheat crops were good, and the oats were also good. The garden and orchard were small, but nicely kept.

The cows were as good as any seen, and dairying on a small scale is indulged in.

Taken all round, this is a nice farm, well managed, and a good example for others.

Mr. W. Batson, Porndeen, was under a disadvantage in that he has not had time to develop his farm of 374 acres, having only been two

MR. W. BATSON'S HORSES AND HOMESTEAD, 2ND PRIZE SMALL FARM.

years in occupation. He is, however, starting on right lines, and in the near future promises to be a hard competitor to beat. A nice homestead of Egyptian brick, of five rooms, well appointed, has been well built, with a garden just established surrounding; some nice young fruit trees are coming on. The fences and general subdivision is good, and a good barn and stable, well planned, has been erected. The water supply has been well thought out, but is capable of further improvement. The fallow is in good order, but on a smaller scale, naturally, than Mr. Hoffman's. His equipment, as far as it went, is good, and time will no doubt add much more machinery to the place.

There was a well stocked fowl yard, but fowl houses have not yet been given much attention.

Mr. Batson's horses were few in number, but well chosen and well cared for.

A good beginning has been made on this farm, and evidently careful thought is being given to each operation undertaken. Buildings are being well planned with a view to convenience and utility in the future.

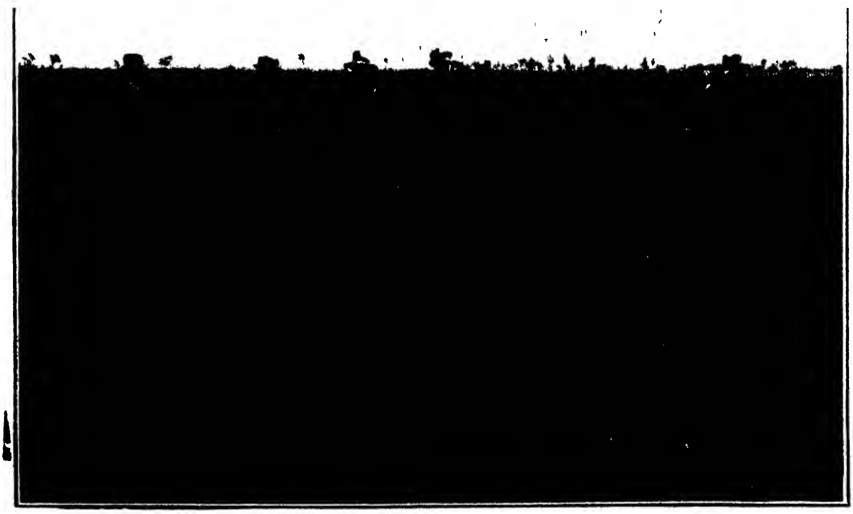
and Mr. Batson is full of ideas for the improvement of the farm, which, however, will take time to effect.

It will be interesting to again visit this farm in the course of a few years to note the development which I feel sure will take place.

Best Crop.

Undoubtedly the best crop seen was that of Mr. R. F. Smith, of Kiata, grown on a black flat, and sown in May, which, last season, meant sown dry. The variety was Federation, and the amount of seed used 50 lbs. per acre, with a manurial application of 40 lbs. of superphosphate. The seed was pickled in bluestone.

Mr. Smith secured the seed from Dookie, and, provided no trouble is experienced in harvesting this crop, a splendid yield should result. The growth was very fine, being thick, strong, and even, the heads long and well filled, and the whole crop unusually clean and free from disease and weeds. An odd foreign head was visible, but these were few



MR. PETER BONE'S SECOND PRIZE WHEAT CROP.

and far between, and the wheat was very true to type. If Mr. Smith grades the seed, the whole crop should command a special value as seed wheat, more particularly seeing that the seed from which this actual crop was grown has so recently been brought from another district. I understand that it is the intention to hand pick the few foreign heads—a wise proceeding in this case. I do not think an estimate of 36 bushels excessive, and the owner is to be congratulated in having such a beautiful crop. It is shown on the cover block of this *Journal*.

Mr. Peter Bone, of Woorak, comes second with a fine crop sown in May, not so heavy as the first placed crop, but very even and clean in the bottom, well headed, and level as a board. This crop was sown dry at the rate of 60 lbs. per acre, with 50 lbs. of super. There were very few foreign heads, and practically free from wild oats, and, though not quite as heavy as some crops seen, will yield somewhere about eight bags.

Mr. Bone grows College Purple Straw and Marshall's No. 3 in addition to Federation, and speaks highly of both varieties. He harrowed his crop twice after it was up, which accounts for its cleanliness in the bottom, and also, possibly, for its general success. He is also a believer in the fallow oats, fallow wheat rotation. A nice crop of peas was seen on this farm, which was roughed in without a fallow, and sown at the rate of 1 bushel per acre, proving that peas will grow well and give a large body of feed for stock.

Mr. F. C. Dahlenburg comes third in this section for a very fine crop, which, though it will yield probably more than the second, was not as clean, and contained some foreign heads and a fair quantity of wild oats.

Many other good crops were seen in this section, the next best being those of Messrs. G. and H. Crouch and McKenzie, and so long as the district produces similar crops its reputation will not suffer.

Best Mallee Crop.

Mr. D. R. McKenzie takes first place in this section with a very nice crop of Federation, which should strip about seven bags, sown in July at the rate of a bushel, with 56 lbs. of super, pickled with bluestone. This crop, though on the short side, was thick and very well headed, also cleaner than all the Mallee crops seen, with the exception of Mr. R. Smith's, of Yanac.

Mr. F. W. Schultz, of Glenlee, is second with a very nice crop of Viking, which he claims is superior to Federation in many respects. This crop was not pickled, but showed no smut, and was even and regular. Wild oats were fairly thick, but the high habit of growth of this variety would be found an advantage during harvesting. It is, however, liable to shake, is very early maturing, and makes good hay.

Mr. Alf. Smith, of North Yanac, has a good crop, sown at the rate of 50 lbs. per acre, with 40 lbs. of super, seeded in April. This crop was very clean in the bottom, and free from wild oats, with no foreign heads. It was slightly tipped, and on the thin side, but should yield about five bags. The fact that this crop was grown on virgin country no doubt had a big influence on its clean condition.

Best Fallow.

The fallow on the whole was very even in character, the moisture condition being, of course, good throughout after the recent rains. Much the same system is adopted by every farmer, though some put more work in than others. Mr. Geo. Crouch, of Kaniva, showed a beautiful paddock of fallow, even and loose on the surface, with a fine firm seed bed, very clean, and not too fine or too cloddy.

Mr. Dahlenburg pushes him closely on points, but failed to beat the former owing to the somewhat crusty state of his fallow, which another working would rectify.

Mr. Keam also had a good fallow out. It was cloddy in places, and had some barley grass showing in patches. In several cases sheep had not been put on early enough, and the weeds were seeding; in others a stroke of the cultivator or harrows before harvesting operations came on would have been advisable.

The amount of fallow seen augurs well for the coming year's crop. The use of the scarifier harrow would be advantageous in some of the sandy soils, as it would have the effect of bringing the clods to the surface and letting the fine soil to the bottom, so making a better mulch and seed bed.

SUMMARY.

In conclusion, I should like to say that the opportunity given me of such a comprehensive run round the district has been very highly appreciated, and the quality of the land seen and general resources have left a deep impression of its value, both present and prospective. At the same time I should like to suggest that more attention towards the maintenance of the soils' productiveness should be taken than is apparently the case. The constant cropping with one or two kinds of crop only must tend to use up the available plant roots in undue proportion, and a system of rotation such as that spoken of would do much towards this end. This has been the experience in all the older countries of the world, and must follow here in due course. Prevention is better than cure in this respect, and the sooner steps are taken to bring about better systems, the less danger there will be of trouble. A striking example of the effect of farmyard manure, in which the humus supplied is probably the greatest value, was seen at Mr. G. Crouch's, where a patch of wheat stood out above all his other crops where the land had been treated to a top dressing of this class of manure. That there are old-established farmers in the district who are fully alive to these matters is beyond doubt, and it is very satisfactory to find that there are young men equally keen, with plenty of grit, coming on.

On the border of the great desert one case was met where a boy of fifteen had put in and grown a very nice crop of wheat, and showed the greatest interest in his work, and a desire for information that would lead to better prospects.

Another case of a young man who had come away from home and tackled the land, rather against his family's wish, and was making a success of farming, while, in yet another case, a man who was working for wages twenty years ago now had some 2,500 acres of land, worth £5 per acre, 600 acres of which were under wheat and oats, 500 sheep, and all the necessary appliances for conducting his farm operations.

These were cases that came under notice, and there are probably many others. All this goes to prove that not only is the land good, but there are some of the right men on it. The freedom with which all topics were discussed in connexion with farming pursuits was particularly pleasing, and the genuine hospitality shown greatly appreciated.

I should also like to take this opportunity of thanking those gentlemen who so kindly and generously lent their cars to expedite the work of judging, without which the time occupied would have been much greater and the work more arduous.

Mr. Towns, the Secretary, accompanied the judge on all occasions, and the Society is to be congratulated upon having the services of a man so thoroughly interested in its welfare, and success of these competitions which are evidently having beneficial effects on the farms and farmers of Nhill.

BEST BIG FARM. 1912.

Name.	A. Best System of Cropping, Rotation, and Cultivation.	B. Character, Condition, and Value of Farm Crops.	C. Condition of Fallow Area.	D. Live Stock: Pigs.	D. Live Stock: Horses.	D. Live Stock: Sheep	D. Live Stock: Cattle	D. Live Stock: Fowls	E. Farm Equipment.	F. Fences, Gates	G. Water Storage	H. Buildings Arrangement, &c.	I. Orchard, Vegetable Garden.	K. Reserve Fodder.	L. Tree Planting.	M. Insurance	Total
Points—Max.	35	20	20	5	25	20	10	5	20	20	45	20	10	20	5	5	
Dahlenburg, F. C.	30	14	17	3	22	15	7	4	19	14	38	20	10	15	3	1	227
Crouch, G. ..	30	16	18	2	18	16	7	3	17	17	36	18	4	14	2	3	221

BEST SMALL FARM. 1912.

Name	A. Best System of Cropping, Rotation, and Cultivation.	B. Character, Condition, and Value of Farm Crops.	C. Condition of Fallow Area.	D. Live Stock: Pigs	D. Live Stock: Horses	D. Live Stock: Sheep	D. Live Stock: Cattle	D. Live Stock: Fowls	E. Farm Equipment	F. Fences Gates.	G. Water Storage	H Buildings Arrangement, &c	I Orchard, Vegetable Garden	K Reserve Fodder	L Tree Planting	M Insurance	Total
Points—Max.	35	20	20	5	25	20	10	5	20	20	45	20	10	20	5	5	
Hoffman ..	27	12	16	0	20	13	8	5	16	12	34	16	7	15	3	4	205
Batson, W. ..	28	12	15	3	18	10	5	4	14	14	30	16	6	14	3	3	195
Pohlner, H. A. ..	27	11	15	2	13	14	7	4	13	12	30	16	6	14	4	4	192

Best Crop, 1912.

Name.	Freedom from Weeds	Freedom from Disease.	Evenness	Trueness to Type.	Apparent Yield	Total.
Max.	15	15	15	20	35	100
Smith, R. F. ..	13	15	14	18	35	95
Bone, Peter	13	15	13	17	30	88
Dahlenburg	12	14	11	17	32	86
Crouch, G.	11	15	10	18	27	81
McKenzie, D. R. (No. 2)	12	14	11	17	27	81
Crouch, H.	11	14	10	17	25	77
McKenzie, D. R. (No. 1)	11	14	8	17	24	74
Greenwood, W. G. ..	9	14	7	17	23	70
Werner	9	14	8	16	22	69
Gladigan, and ..	8	14	7	16	20	65
McMillan, Wm. ..	9	14	7	12	20	62
Muir, Lawson ..	8	14	7	12	20	61
Pohlner, J. F. A. ..	7	14	7	13	20	61
Pilgrim and White ..	8	14	7	12	18	59

Best Fallow, 1912.

Name	Moisture.	Depth and Character of Mulch.	Freedom from Weeds.	Evenness.	Condition of Surface Clods.	Total.
Max.	10	10	10	10	10	50
Crouch, G.	10	9	9	9	9	46
Dahlenburg, F. C. .	10	8	9	9	9	45
Keam, R. G. ..	10	8	8	8	8	42
McKenzie, D. R. ..	10	7	8	8	7	40
Hoffman	10	8	8	7	7	40
Muir, Lawson ..	10	7	7	6	8	38
Reichelt, C. F. H. ..	10	6	6	7	7	36
Pohlner, J. F. A. ..	10	6	6	7	7	36

Best Mallee Crop, 1912.

Name.	Freedom from Weeds.	Freedom from Disease.	Evenness.	Trueness to Type.	Apparent Yield.	Total.
Max.	15	15	15	20	35	100
McKenzie, D. R. ..	12	14	13	17	30	86
Schultz, F. W. ..	10	14	12	16	25	77
Smith, Alf.	12	14	12	15	20	73
Marshall, T., and Sons	10	13	11	15	20	69
Keam	10	13	10	14	20	67
Dart and Simons ..	8	13	8	14	17	56

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STANDPOINT.

(*Continued from page 37.*)

PART IV.

OVERSEA EXPORT TRADE.

By E. Meeking, Senior Inspector of Fruit.

Growth and Development of the Trade.

Prior to the year 1891 no continuous export of fruit from this State to countries oversea had been undertaken, although small lots had been previously exported by some growers from Harcourt and a few other districts at irregular intervals. In the year mentioned, however, the regular annual exportation of consignments commenced on a commercial scale, and has continued uninterruptedly to the present. The rapidity with which the trade has expanded has been shown in various reports which have been issued from time to time by the Department of Agriculture, and a detailed recapitulation is unnecessary. The graph shown hereunder should portray a more forcible realization of the total expansion than can be expressed in words. It may, nevertheless, not be out of place to furnish a detailed list showing how the industry has progressed during succeeding seasons:—

Quantities and Values of Fruit Exported to Oversea Countries from 1891 to 1912, inclusive.

Season	Quantities.	Values £
1891-2	1,638 cases	819
1892-3	3,308 "	1,654
1893-4	3,254 "	1,627
1894-5	8,388 "	4,194
1895-6	14,544 "	7,272
1896-7	22,010 "	11,005
1897-8	10,196 "	5,098
1898-9	15,248 "	7,624
1899 (May and June)	1,220 "	610
1899-1900	11,649 "	5,825
1901	36,050 "	18,025
1902	43,328 "	21,664
1903	87,993 "	43,996
1904	51,459 "	25,729
1905	58,511 "	29,255
1906	59,670 "	29,835
1907	139,009 "	69,504
1908	102,484 "	51,242
1909	204,678 "	102,339
1910	162,357 "	81,178
1911	297,400 "	148,700
1912	305,623 "	152,812

It will be seen from the figures of this list that for every 100 cases shipped in 1891, 19,062 cases were shipped in 1912. During the past five years (1906-1912) the expansion has been particularly rapid. This accounts in a large measure for the fact that the handling, transporting, and marketing arrangements have of recent years been altogether inadequate to keep pace with the increasing volume of trade.

The Importance of Proper Handling Facilities.

This absence of sufficient facilities for handling, transporting, and marketing the yearly output of our fruits is becoming an increasing disability to the trade each season, and is one which, if not quickly remedied, threatens to permanently retard the development of the industry, or, in fact, to imperil its very existence. The matter is one of national importance, for it must not be forgotten that the success of the immigration and closer settlement movements is largely dependent upon the development of the fruit industry on sound and profitable lines, as the business of fruit-growing is one which lends

itself to a successful occupation of small holdings perhaps more than any other branch of agriculture. A good income may be obtained from 10 to 15 acres of land bearing fruits of good marketable varieties. The pursuit, moreover, is one in which much of the drudgery and objectionable work connected with other forms of agrarian industry is conspicuous by its absence. In addition to these facts, it should be remembered that first class land is not necessary for raising good fruit, and that the problem of enabling settlers to embark in this occupation is simplified by the fact that the limited cost of the land is much less than is the case where the settler intends to carry out intense cultural methods connected with many other agricultural pursuits.

A large portion of our 12 millions or so of acres of Crown lands still inalienated is eminently suitable for fruit-growing, especially that portion which is classified as second class and auriferous, and as third class. If, however, the problems connected with the successful placing of our fruits on distant markets are ignored, very little benefit will be derived from the natural advantages which exist for the development of the industry, as its future welfare is dependent upon the rapid and

permanent expansion of the oversea export trade. So far, the handling, transportation, and marketing of fruits have never been specialized, as it has not been realized to the full that fruit, being a very perishable product, requires the application of unique methods for successfully placing it upon distant markets.

Before giving suggestions for improvements in the present methods, it will be desirable to outline those methods and to attempt to prove that a non-application of certain details in these is mainly responsible for the uneven and often unsatisfactory prices obtained during each succeeding season.

Inadequacy of Present Handling Facilities.

As long ago as 1898, Mr. J. Knight, the Departmental Expert on Fruit and Special Industries, who then had control of the examination of fruit intended for export, reported as follows:—"In my opinion a radical change is required in the present system of inspecting and packing green fruit for export. According to existing arrangements, fruit that has been inspected is simply placed on open wharfs alongside the vessel in which it is being shipped. Under such conditions it is really impossible to inspect the fruit in the thorough and systematic way that it ought to be done. A better system is urgently required, and I would suggest that a special receiving depôt should be established in Melbourne, provided with the necessary conveniences, to enable the work of inspection to be done thoroughly and expeditiously. Further, I would suggest that several provincial depôts should be formed in the principal fruit-growing centres. The adoption of this suggestion would enable many growers to share in the export trade who otherwise must hold back owing to the difficulties in the way.

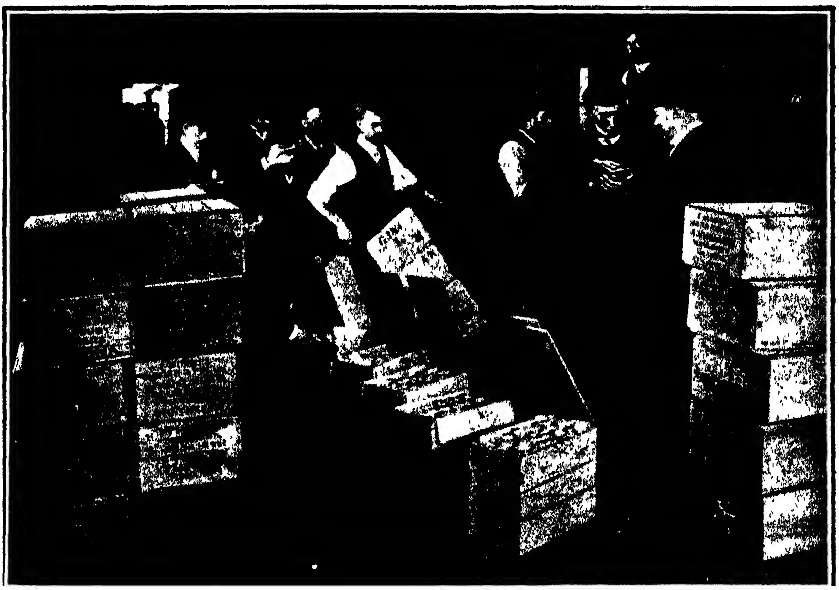
"At these depôts the fruit could also be repacked and graded properly, growers being too often careless in these respects. The extra expense that would be incurred in carrying out my proposals could be fully covered by making a small charge per case for the fruit sent in. . . . . . Then, again, the knowledge that large quantities of prime fruit were passing through a metropolitan or other receiving depôt might probably be an inducement to English firms to become direct buyers, and this would be greatly to the advantage of growers."

Slow Improvements in Handling Facilities.

The above lines of argument were taken up by Mr. J. G. Turner, who was then Senior Inspector, Fruit, Imports and Exports, and who assumed control of the work of examination in the 1900 season. These have since been strenuously advocated by that officer and his staff; but, unfortunately, the matter has not been given the serious attention by growers, agents, and others concerned, which its importance deserves.

In the year 1907, owing to the rapid increase in the trade, it was seen that the matter of handling and presenting consignments for examination at the ship's side prior to their export had become too big a matter for the agents to handle successfully under the conditions then prevailing. The Department of Agriculture, therefore, obtained from the Railways Department a lease of a portion of one of the grain sheds at Williamstown, and also a lease of the old dumping shed at Port Melbourne, where consignments could be asembled, handled, inspected,

and adjusted prior to placing on board outgoing vessels. The work, which constitutes the most difficult portion of the business of fruit shipping, was carried out by the Department of Agriculture until the year 1912 as a temporary expedient until such time as the exporters should make arrangements for carrying out the work themselves, as it was considered that the Department was incurring a large expense which should rightly be borne by the exporters. It was, therefore, decided, in 1911, that the work in future seasons should be undertaken by the exporters themselves. This procedure was consequently adopted during the 1912 season, but the exporters were relieved of a portion of the burden by the Department stationing officers at certain of the country stations. Consignments from these stations were examined at time of despatch and consigned directly to the ship's side without further handling or inspection in Melbourne. Judging from results,



DEPARTMENTAL OFFICERS ADJUSTING CONSIGNMENTS.

it cannot be said that the system has proved altogether satisfactory, as the matter of adequately inspecting consignments under these conditions is very difficult of accomplishment. As a consequence, the quality of the fruit marketed during the 1912 season left much to be desired.

Disabilities Accentuated with Increasing Trade.

It will be realized to what extent the disabilities have intensified since the year in which Mr. Knight furnished the above report, when we consider that in that year (1899) only 12,869 cases were exported, and the present facilities for adjusting and handling consignments are little better than they were in 1899, although it is estimated that during the forthcoming season (1913) upwards of 400,000 cases will be shipped. The bulk of this total will be despatched within a period of some weeks, or an average despatch of 40,000 cases per week. This

average will, of course, not be uniformly distributed throughout the period, as, during certain portions of the same, 70,000 or 80,000 cases will sometimes be forwarded within the space of two or three days. This uneven distribution is unavoidable, as the sailing dates of the vessels, which must be arranged by the shipping companies with regard to their business as a whole, cannot be altered.

As the Railways Department does not possess sufficient trucks of a suitable type to cope with the rush of consignments, fruit is often despatched from country centres during the hottest portion of the year in any type of truck which may be available. In consequence, the fruit conveyed in such trucks often reaches the ship's refrigerator in an overheated condition. The Railways Department has been subjected to considerable censure by growers and exporters in connexion

LOADING FRUIT FROM LOUVRE TRUCKS.

with this matter; but consideration has not been given to the fact that the construction of sufficient trucks of a suitable type to meet the irregular rushes of consignments which take place within short spaces of time would, from a business point of view, be an unwise proposition, as a large proportion of these trucks would be standing unused in the yards during the greater portion of the year. Under present conditions, moreover, the full carrying capacity of trucks is not utilized, as many arrive at the ship's side incompletely filled. This tends to congest the traffic on the piers at Port Melbourne and Williamstown, and also entails an immense amount of unnecessary labour in shunting, handling, &c. At present the Railways Department possesses 690 trucks of the louvre type, and 170 ice cars of various types, for the conveyance of perishable produce.

It is considered that provision for an up-to-date receiving and pre-cooling depôt in the metropolis, the thorough grading of all

consignments, and improved methods of harvesting, packing, transporting, and marketing are the only complete solutions of the present troubles which beset the trade. The reasons for such belief will be given later on.

GOVERNMENT ASSISTANCE—BONUSES, LEGISLATION, ETC.

In addition to the before-mentioned assistance which the Customs Department has given the industry by handling and adjusting consignments for five years, a bonus of 1s. per case was given to exporters of fresh fruit by the Department of Agriculture in the early years of the trade to encourage the growth of the industry. Bonuses to encourage the export of fruit pulp, and also the planting of vines and fruit trees were provided. This system was inaugurated in 1890, and was continued until the year 1902, when it was discontinued, it being then considered that the trade was sufficiently well established to continue without assistance from the authorities. The amounts paid were disbursed as follows:—On export of fresh fruit, £12,395. On export of fruit pulp, £3,262. For planting of vines, £19,878. For planting fruit trees, £21,256. A total of £56,791 was consequently paid during the period in which the system was in force. It will thus be seen that the charge of neglecting to encourage the industry which has been levelled at the Commonwealth and State authorities is not borne out by facts.

In the year 1898 the Exported Products Act was passed, and all fruit, prior to export, was required to comply with the provisions of that measure. These provisions, so far as fruit was concerned, were simple—only demanding that fruit should be sound and free from disease, and the determination as to freedom, or otherwise from disease, was left to the Inspector. In 1906 this Act was superseded by the provisions of the Commonwealth Commerce Act, and since that time to the present fruit has been exported under the provisions of the latter measure. These provide that fruit must be in accordance with the trade description placed on the outside of packages. The provisions of this measure are not so simple as those of the old Exported Products Act, but they are not so efficient in preventing the export of inferior fruit as were the provisions of the older measure. It would appear that a mere trade descriptions Act is not exactly the type of legislation to effectively raise the standard of primary products, which seemingly requires special legislation of a technical nature to bring about the desired result.

(To be continued.)

A WELLINGTON paper states that the New Zealand "flax" industry is booming, owing to enhanced prices. One large mill would be clearing £2,000 per week. There are hundreds of small mills in New Zealand. This fibre plant (*phormium tenax*) thrives well in Victoria in suitable damp localities, and, in view of the demand ruling, attention may be directed to an article in this Journal of June, 1906, when instructions for the establishment of plantations were given. Since that date prospects have further improved by better methods of handling the leaf.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Orchardists will be busy during February with the gathering and marketing of early and export fruit. In gathering fruit every care should be taken to see that it is not in any way bruised or crushed. This if often the cause of fruit decaying so rapidly and of the deterioration of fruit in the fruit-room. All fruit should be handled as lightly as possible.

Another point to be observed is the necessity for grading fruit for the market. Grading pays, and it pays handsomely. A buyer will never offer a good price for mixed grades, more especially as he will probably require to regrade it if he wishes to resell it. A good price will always be obtained for first grade fruit, while the low price offered for fruit of mixed grades can generally be secured for the lowest grade as well. The more exact the grading, the more profit for the fruit-grower; the more care in packing, the more returns for the producer; and so the greater care and exactness, the better it pays to grow fruit.

A final spraying for codlin moth will be necessary this month. Probably, owing to the irregular season, the moth has been more active during this season than last. The fallen fruit should all be collected and boiled, and all crevices and hiding places searched for larvæ.

The season has been favorable for the development of bryobia mite and woolly aphis, and, as soon as the fruit has been picked from the trees attacked by these insects, a good spraying of strong tobacco water should be given. This will minimize to a great extent the winter work.

Cultivation should still be proceeded with, and the soil kept in a continual condition of surface friability. This is especially necessary at this time of the year. Now that a good supply of rain is in the soil, it should be well conserved, so that the growing period of the trees may be continued until early autumn, when the trees should be allowed to ripen their wood.

Budding may be continued; and if an early start were made, the buds may be allowed to push their way out into growth, so that they may harden and be ready for pruning in the proper season. Buds that are placed in late season should be left dormant until the spring-time. Summer pruning may also be continued, and all superfluous terminal lateral growths removed, so as to strengthen the remaining buds and also to force out fruit buds for next season.

FUMIGATION.

Evergreen trees, including those of the citrus family that are infested with scale, should now be sprayed or fumigated to rid the trees of this pest. For spraying, a weak red oil emulsion, lime, sulphur, and salt spray, or resin wash will be found useful for the purpose. The most successful method, however, of dealing with the scale pest is by fumigation. The trees should be closely enveloped in an airtight

sheet or tent, and hydrocyanic gas should be generated inside. The chemicals for generating the gas, as well as the fumes of the gas itself, are excessively dangerous, and great care should be exercised in their manipulation. A wooden, enamel, or earthenware vessel is placed inside the tent, the vessel containing a mixture of 4 fluid ounces of sulphuric acid and 12 fluid ounces of water, the acid being placed in the vessel first. Four ounces of cyanide of potassium should then be quickly dropped into the vessel and the tent closed down at once; the bottom of the tent all round should be covered with soil to prevent any of the gas escaping. The operator must take care that not the slightest portion of the fumes is breathed. Fumigation should be carried out at night-time or on a cloudy day, and the foliage of the trees must be thoroughly dry.

Vegetable Garden.

The vegetable garden will require abundant water at this time of the year; liberal dressings and mulchings of manure will also be needed. These conditions, together with hoeing and soil stirring where necessary, are needed to produce succulent summer and autumn vegetables. All vacant plots should be well manured and deeply dug over in anticipation of the planting of winter and spring vegetables, the manure being worked in as deeply as possible. All vegetable and animal manures should be well rotted before being used for the garden.

Seeds of leek, Brussell's sprouts, summer cabbage, and cauliflower, carrot, turnip, parsnip, silver and red beet, peas and French beans may still be sown. Celery plants should be planted out into rows, and celery seed may also be sown for successive crops. Celery is a very popular winter vegetable, and it would be much more grown, if it were thoroughly understood. A bed of celery should be in every garden, and it is certainly very easy to produce. It is valuable as a salad, a boiled vegetable, and for flavoring soups; it is also a reputed reliever of rheumatic pains and affections. The seed should be sown from December to February, according to locality. It is best to sow the seeds in boxes or seed pans, covering them with glass to induce quick germination. The soil should be very fine and friable. When the young plants are from 1½ to 2 inches high, they should be planted out in boxes or in sheltered beds; and as they grow and become stronger, they should be planted out in their place in the garden. Rich, cool, and moist pulverized soil, well worked, and kept free from weeds, and careful attention, are all the requirements of the celery bed. The celery plants are generally planted out in trenches; and as they grow, earth is heaped up around the plant so as to thoroughly blanch the stems. An American method of blanching is to place a board on each side of the rows of celery plants, and secure them closely in position, so that as much light as possible is excluded. It is claimed for this method that it is a far cleaner way than the earth blanching; but the latter system produces a better quality of celery. There is a variety known as self-blanching, being naturally of a whitish growth. It is not to be compared to the varieties which are blanched by forcing, but it is very useful for soups and for flavoring.

Flower Garden.

The flower garden requires a maximum amount of water and of surface cultivation during the month of February. The season is generally a dry one, the air is hot and dry, and hot winds are sometimes prevalent; and it is impossible to expect that so many plants which are now flowering, will put forth their best efforts, without the aid of ample water and cultivation. The main autumn flowers, Cannas, Salvias, Dahlias, Penstemons, Chrysanthemums, and many plants of the herbaceous section, are now in full flower or are preparing to furnish their blooms. These will all require ample moisture, and in the case of rapid growing, succulent plants, such as the dahlia, a good mulching with stable or poultry manure is required. Flowering trees and shrubs, such as Oleander, Poincianja, Virgilia, Lagerstrœmia, Acacia elata, and many others, are now in full bloom: and if the gardener has room for any of these, they should be noted for future planting.

Delphiniums should have their old flowering stems cut down, so that they may give another succession of autumn blooms. The plant should be well mulched and watered after cutting the old stems.

Carnations may be layered, keeping the layers continually moist and cool until they root. Cuttings of all pelargoniums, zonale and regal, may now be planted; a few spring bulbs for early blooming may also be planted: and seeds of perennial and hardy annuals may now be sown. Included among the seeds to be now sown are those of Sweet Pea, Wallflower, Iceland Poppy, Anemone, Ranunculus, Stock, and Pansy.

Beds and plots for the planting of daffodils, hyacinths, and other spring flowering bulbs should be thoroughly dug and worked over, and the subsoil should receive a good soaking.

Chrysanthemums should be thinned out, and staked, if this has not previously been done. The floral buds should be selected, and all others pinched out; and the plants should then be fed wherever necessary.

All old flower heads should be removed from the rose bushes. In March the plants may be thinned out, manured, and generally prepared in anticipation of the crop of autumn blooms.

All shrubs and trees that have bloomed should have their old flowering stems and shoots thinned out, so as to start fresh growths for filling in spaces, and for next year's blooms.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed	Name of Owner.	Eggs laid during competition. April 15 to Dec. 14.	Dec. 15 to Jan. 14.	Total to Date (9 months)	Position in Competition.
40	White Leghorns	S. Brown	1,038	140	1,178	1
47	,, .	J. E. Bradley ..	980	137	1,117	2
31	,, .	G. Edwards ..	974	131	1,105	3
20	,, .	E. Waldon .	969	134	1,103	4
28	,, ..	F. G. Eagleton ..	988	112	1,100	5
62	,, .	R. W. Pope ..	949	135	1,084	6
23	,, ..	W. McLister ..	976	101	1,077	7
37	,, .	C. F. Bertelsmeier .	925	142	1,067	8
9	,, ..	J. Spotswood ..	962	103	1,065	9
25	,, ..	R. L. Appleford ..	916	144	1,060	10
1	,, ..	J. Campbell .	936	119	1,055	11
70	,,	C. J. Beatty ..	916	137	1,053	12
13	,, .	W. B. Crellin .	897	145	1,042	13
39	,, ..	W. G. Swift .	900	132	1,032	14
49	,,	W. Purvis .	886	133	1,019	15
33	,, .	H. McKenzie ..	872	145	1,017	16
24	,, ..	Sargenfri Poultry Yards	889	124	1,013	17
45	,, .	Wooldridge Bros ..	868	143	1,011	18
38	,,	R. Moy .	882	128	1,010	19
29	,, ..	J. B. Brigden ..	884	125	1,009	20
48	,,	Griffin Cant	887	121	1,008	21
14	,, .	J. H. Wright ..	876	121	997	22
53	,, ..	H. Hodges ..	856	136	992	23
63	,, ..	Percy Walker .	852	131	983	24
44	,, ..	A. W. Hall ..	863	118	981	25
50	,, ..	A. Alpee ..	866	114	980	26
5	,, .	J. H. Brain ..	828	138	966	27
46	Black Orpingtons .	H. A. Langdon ..	889	76	965	28
7	White Leghorns .	A. H. Padman ..	857	105	962	29
2	,, ..	B. Rowlinson ..	858	98	956	30
61	Black Orpingtons ..	Jas. Ogden ..	857	98	955	31
6	White Leghorns ..	J. B. McArthur .	851	98	949	32
42	,, ..	Mrs. Kempster .	811	126	937	33
19	,, ..	Cowan Bros. .	810	124	934	34
10	R.C. Brown Leghorns	S. P. Giles ..	797	125	922	35
15	White Leghorns ..	Mrs. Steer ..	819	102	921	36
64	,, ..	H. Merrick ..	787	134	921	
3	Black Orpingtons ..	King and Watson .	850	69	919	38
35	White Leghorns .	C. H. Busst ..	804	114	918	39
30	,, ..	Mrs. Stevenson ..	810	108	918	
32	,, .	S. Brundrett ..	777	140	917	41
69	,, .	Morgan and Watson ..	781	135	916	42
51	,, ..	H. Hammill ..	788	108	896	43
56	,, .	M. A. Monk ..	773	120	893	44
65	,, .	A. H. Thomson ..	762	123	885	45
12	,, ..	T. H. C. Stafford ..	744	137	881	46
60	,, ..	Miss B. E. Ryan ..	767	98	865	47
43	,, ..	G. Purton ..	736	118	854	48
11	Black Orpingtons ..	T. S. Goodisson ..	735	110	845	49
54	White Leghorns ..	F. R. DeGaris ..	749	94	843	50
57	,, ..	B. Walker ..	724	119	843	
66	,, .	J. Moloney ..	694	139	833	52
27	,, ..	E. Nash	740	93	833	
4	,, ..	J. Blackburne ..	719	112	831	54
41	,, ..	A. Stringer ..	728	103	831	
8	Black Orpingtons ..	D. Fisher	735	78	813	56
16	Silver Wyandottes	R. Jobling ..	701	101	802	57
58	White Leghorns ..	W. J. Stock ..	704	95	799	58
55	Brown Leghorns ..	J. Mathieson ..	688	107	795	59
52	Black Minorcas ..	Chalmers Bros. ..	708	75	783	60
68	White Leghorns ..	W. J. McKeddie ..	662	118	780	61
21	,, ..	J. O'Loughlin ..	643	114	757	62
17	,, ..	S. Childs	618	128	746	63
67	Anconas	A. E. Manning ..	631	112	743	64
22	White Leghorns ..	W. N. Ling ..	638	102	740	65
59	,, ..	W. J. Seabridge ..	608	113	721	66
34	,, ..	R. F. B. Moore ..	587	102	689	67
18	,, ..	B. Mitchell ..	591	86	677	68
36	Old English Game	K. J. Barrett ..	574	96	670	69
26	.. .. ..	(Reserved) ..	—	—	—	..
		Totals ..	55,740	8,042	63,782	

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

H. V. Hawkins, Poultry Expert.

REPORT FOR MONTH ENDED 14TH JANUARY, 1913—NINE MONTHS.

The weather has been changeable, but not unseasonable. During the month 71 points of rain fell, followed by a hot spell; the glass steadily rising, and on the 12th and following day the temperature was 103 degrees and 105 degrees in the shade. The majority of the birds came through well, but a few felt the heat so much that their removal from the pens became necessary. One bird, in Pen No. 37, is still suffering from heat apoplexy, and has since been replaced. In the leading pen (Brown's), one hen strained herself, and was isolated for a few days, but not replaced. She is now back with the rest, and looks none the worse; also in Pen No. 2 one White Leghorn has been replaced. Broodies were not so numerous as in November. Mr. S. Brown's White Leghorns are still in the lead, with a total of 1,178 eggs; they hold a lead of 61 over the second pen, belonging to Mr. J. E. Bradley.

The feeding has been slightly altered—during the warm spell the meat ration being still further reduced, and additional green food added—principally thistles and raw onions. In the evening wheat has been the principal grain fed with a small quantity of short oats added.

A few birds are affected with bumble foot, due in part to the dry and hard nature of the soil, and the persistent jumping up at the gates when feeding. In many pens there is evidence of an early moult. The total number of eggs laid during the nine months was 63,782—an average of 924.37 eggs per pen.

On the previous page will be seen the results of the competition to 14th January, 1913.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 3. 10th March, 1913.

WHEAT AND ITS CULTIVATION.

No. XI.—WHEAT VARIETIES.

(*Continued from page 83.*)

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

A large number of inquiries is received at the beginning of each year by the Department of Agriculture for information regarding the merits and qualities of different varieties of wheat grown in the wheat areas. It is proposed in the present article to give in simple language a brief description of a few of the more commonly grown varieties of wheat, and to briefly indicate such features of structure as will enable these varieties to be more or less readily recognised.

It might be mentioned, in passing, that a large number of attempts has been made from time to time by various observers to evolve a workable scheme of classifying the many varieties of cultivated wheat, but, so far, no satisfactory system of classification has yet been obtained. There is a general agreement on the division of the cultivated wheats belonging to *Triticum Sativum* into six sub-species*; but concerning the further classification of the varieties within these sub-groups there is the greatest difference of opinion. Eriksson† has evolved a scheme of classifying the varieties of wheat by the structure of the ear, and particularly by the length and density of the spikelets; but such a scheme must be more or less unsatisfactory when applied in practice, since the head is known to vary considerably from season to season, and with changes in the soil conditions.

Vilmorin‡ has made a very systematic review of French varieties of wheat, but the minor subdivisions of his classification are wanting in definiteness. Cobb,§ of New South Wales, some years ago proposed an ingenious scheme for the universal nomenclature of wheat, and

* *Vide* Wheat and its Cultivation, *Journal of Agriculture, Victoria*, Feb., 1912, pp. 92–93.
† Eriksson, Die landwirtschaftlichen, *Versuch stationen*, Bd. 45, 1894.
‡ Vilmorin, *Catalogue Methodique Systematique des Froments*, Paris, 1894.
§ Cobb, Universal Nomenclature of Wheat, *Agricultural Gazette of New South Wales*, Dec., 1901, *et seq.*

suggested the classification of wheats by a microscopic examination of the aleurone layer. There are considerable practical difficulties in the application of such a method, and, moreover, the system rests on an insecure foundation, since it tacitly assumes that difference in environment and season would have a negligible effect on the aleurone layer.

That there is need for some systematic classification of the varieties commonly grown will readily be admitted. There are many instances of wheat varieties in various parts of Australia masquerading under quite a number of different names.

Until a systematic survey of the characteristics of the hundreds of varieties grown throughout the Commonwealth has been made, and the leading types of wheat standardized, it is expected that there will be considerable confusion with regard to minor varieties.

Some of the more important varieties grown in the wheat areas are the following:—

1. *Early Varieties.*—Bobs, Bunyip, Comeback, Firbank, Gluyas, King's Early, Steinwedel, Thew.
2. *Mid-season.*—Bayah, Correl's No. 3, Dart's Imperial, Federation, Jonathan, Zealand Blue.
3. *Late.*—American No. 8, Genoa, Huguenot, Marshall's No. 3, Medeah, Purple Straw, Yandilla King, White Tuscan.

The above division of commonly grown wheat varieties into early, mid-season, and late is adopted for convenience, and represents the average results of four seasons of observation under uniform conditions.

The line separating some of the early and mid-season wheats on the one hand, and the mid-season and late varieties on the other, is not, as might be expected, very clearly defined.

EARLY VARIETIES.

BOBS.—This interesting variety of wheat was produced by the late Wm. Farrer, in 1896, and is really a hybrid—being a cross between Nepaul Barley and Early Lambrigg Wheat. It is one of the best milling wheats yet produced under Australian conditions. Its grain is hard, shotty, and translucent, and yields a good percentage of flour of very high strength. The flour is very suitable for blending purposes. It is a very popular variety in New South Wales, and it has given very satisfactory yields in dry as well as cool, moist districts. It is a very early, spare-stooling variety, with erect, light-coloured, hollow straw. The ears are white, beardless, and smooth, somewhat lax in character, broad, and open in the chest, carrying small, shotty, plump, translucent grain which tends to shell out. On account of the excellent milling quality of the grain it has long since been a favorite with millers, and prices in advance of f.a.q. rates have regularly been paid for parcels of this variety. Its yields in most of the wheat areas of Victoria have not been very satisfactory; and, in spite of the enhanced prices, it has not generally given such good financial returns as other more prolific varieties.

BUNYIP.—This is a very early, upright, moderately tall, stronggrowing variety of fair stooling power, and is a very useful variety to sow in dry districts when the season is late. The ears are yellowish

white, broad, awnless; but the upper spikelets have a slight tip beard. The grain is hard, plump, and attractive, of good milling quality, and yields a flour of high strength. It does not readily shell. On account of its extreme earliness it gives best results in normal seasons when sown in the middle or towards the end of the season.

COMEBACK.—This is an early variety, of fair stooling capacity, moderately tall, with clean, hollow straw, and makes a very nice sample of hay. The ears are creamy-yellow, beardless, and smooth, of moderate length, fairly compact, but with a long tapering tip. The grain is small, somewhat shotty in character, thus resembling Bobs, with hard semi-translucent endosperm. The grain is of high milling quality, and, like Bobs, is eagerly sought by millers, making a good percentage

MARSHALL'S NO. 3. GLUYAS. CORREL'S NO. 3.

of high-quality flour very suitable for blending purposes. It has been sold on the Sydney and Adelaide markets at various times at 3d. to 6d. per bushel above ordinary f.a.q. wheats. It has the reputation of being a shy yielder, but in some of the drier districts it has done remarkably well. There is a number of strains of Comeback in cultivation, and some of these are recognised as of more value than others. Among these latter might be mentioned Pratt's Comeback, originated by Mr. Pratt, of Two Wells, South Australia, to whom the late Mr. Farrer sent a sample of the original cross. Comeback is a crossbred wheat of Fife-Indian parentage, and may be considered the best milling wheat yet produced under Australian conditions.

FIRBANK.—This is one of the most popular hay wheats in the Riverina, and for some years past the demand for seed of this variety has been unprecedented. It is an early, tall-growing, erect variety of moderate stooling capacity, with good heavy flag. The straw is strong, yet hollow, and makes sweet hay of good quality, which retains its colour well. The ears are long, smooth, lax, open, and tapering, with slight tip beards. The chaff is of a yellowish-white colour, and holds the grain somewhat loosely, and possesses very short, stiff, terminal awns. The grain is large, plump, and soft. It is rather liable to flag smut and rust. It is essentially a hay wheat.

GLUYAS.—This variety is very popular in the Mallee districts of South Australia on account of its early maturity, general immunity from disease—particularly its rust-resisting powers—and its capacity for yielding well in dry seasons. It is vigorous, moderately tall growing, early variety, fair tillering power. It is, however, somewhat weak in the straw, and has a tendency to go down, particularly in heavy weather. The ears are dark-bronze in colour, moderately compact, and possess a slight tip beard.

As the grain approaches maturity, the dark heads become pendulous, but do not shell on account of the firmly closed enveloping glumes. It is a very useful variety for sowing in dry districts in a late season.

KING'S EARLY.—This is another very popular early variety in Mallee country, which yields well in a dry season. It is a selection made many years ago by the late Joseph King, of Georgetown, South Australia. It is a vigorous, tall-growing variety of moderate stooling capacity, possessing semi-solid straw with a fair amount of flag. The ears are bearded, white, somewhat open; and the grain large, plump, and of low strength. In spite of its beard, it is prized as a hay wheat on account of the solidity and sweetness of its straw, and the capacity to retain its colour well. It is a very old variety; but during recent years it has been greatly improved in yielding capacity by Professor Perkins.*

STEINWEDEL is a very popular, early maturing variety, extensively grown in Victoria, South Australia, and New South Wales. It originated from a selection made from a crop of Farmer's Friend—one of the old Purple Straw varieties. It is a free stooling, moderately tall-growing variety, with drooping foliage and strong, hollow, purplish straw. The ears are smooth, white, bold and large, with broad spikelets and a slight tip beard. The grain is large, bright, plump, but soft and mealy. It is easy to mill, and the flour is of good colour but of low strength.

This variety has a strong tendency to shell, and the crop should, therefore, be harvested as soon as it reaches maturity in order to obviate losses. It is a good yielder in the drier areas, and can be relied on to do well in a dry spring.

THEW is a remarkably early vigorous-growing wheat, possessing good stooling powers. It is a moderately tall grower, with stiff narrow flag and medium-sized hollow straw. It cures a good colour, and in some early districts has given good yields of hay and green stuff. It has been singularly free from rust during the past few years, but

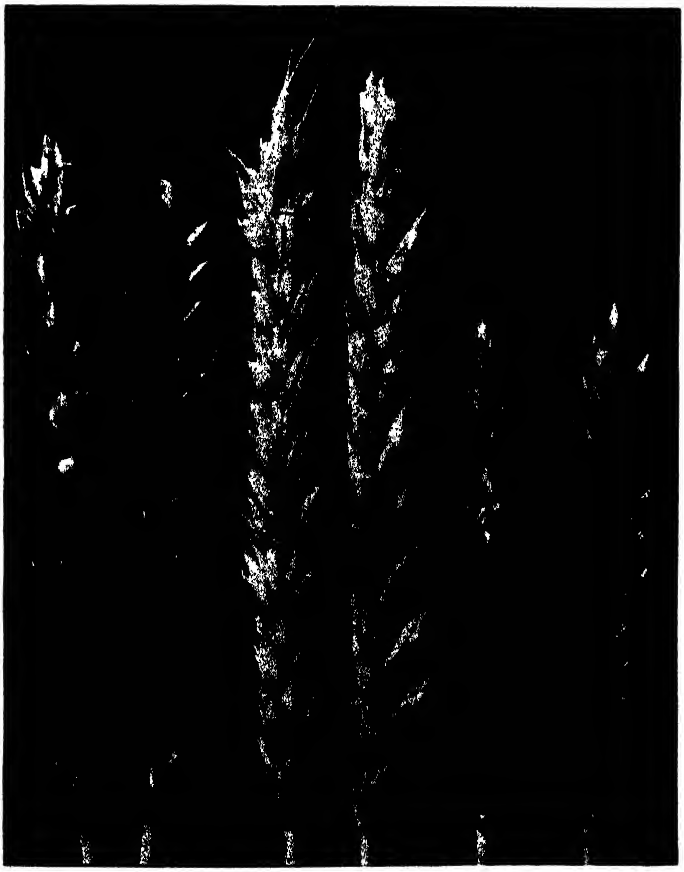
* *Vide* Improvement of Cereals, Perkins and Spofford, *Bulletin*, South Australian Department of Agriculture.

this may probably be due to its rapid maturity rather than the possession of actual rust-resisting powers.

It has a long tapering beardless head, with smooth white chaff, and somewhat lax spikelets, which, however, hold the grain well, and cause some difficulty in threshing. It is a crossbred wheat with improved Fife parentage, and is a very good hay wheat.

Mid-season Varieties.

BAYAH is a crossbred wheat with improved Fife and Jonathan parentage. It is a mid-season variety which very closely resembles



BAYAH. TRIUMPH. HUGUENOT.

Federation in the colour of the chaff and the short upstanding straw. It is a very vigorous grower, of good stooling capacity, with well-developed, shapely, dark-brown, compact ears with clubby tops. The chaff is smooth, but the spikelets near the tip are slightly awned. The grain is plump, soft, and white. On account of the short stiff straw it is not suited for hay, though its grain yields have been very satisfactory.

CORREL'S No. 3.—This is one of a number of varieties originated by Mr. J. Correl, of Arthur River, Western Australia, the originator

of the Le Huguenot Wheat. Correl's No. 3 is a tall-growing, vigorous variety, with good, strong, semi-solid straw, and a good stooler. It retains its colour well when cut for hay, and makes a very good sample. It possesses a good compactly-built ear, slightly awned at the top. The chaff is dark-brown in colour, and smooth, whilst the grain is large and moderately plump.

DART'S IMPERIAL.—This popular variety was originated by Mr. Thomas Dart, of Nhill, Victoria, formerly of Lucindale, South Australia, and is a selection from a purple straw variety. It is one of the oldest varieties in general cultivation at the present time. It is a good all-round grain and hay wheat, and is a very reliable yielder in most wheat districts. It is a tall-growing variety, with good stooling powers, but hollow stemmed, and possessing considerable foliage. The heads are well developed, square and compact, with broad, smooth, cream-coloured spikelets, somewhat crowded towards the tip, giving the top a club-like appearance. The chaff is smooth, but possesses slight awns towards the summit of the head. The grain is soft, white, and mealy, and not of high strength. The grain is easily milled, and it belongs to the weak flour group of wheats, though the colour of the flour is excellent. In Departmental variety tests the yields of Dart's Imperial have usually stood out prominently, and confirm the opinion that this variety is a good prolific standard type for most of the wheat areas.

FEDERATION.—This is, without question, the most popular and prolific variety of wheat in general cultivation at the present day. It was produced by the late Mr. Farrer, Wheat Experimentalist, of New South Wales, from a cross between Purple Straw and Yandilla. Yandilla is a cross between Improved Fife and Etewah, an Indian variety. The production of this wheat was probably the greatest of Mr. Farrer's many triumphs in wheat breeding, for none of his many successful crossbred wheats have enjoyed such a wide measure of popularity as Federation. Indeed, during the last six years the golden yellow characteristic of old time Australian harvest fields has been gradually changed to a dull bronze through the ever-increasing popularity of Federation wheat. This popularity has been won by sheer merit, for Federation, when seen in the field for the first time, is decidedly unattractive in appearance, especially when grown side by side with the showy wheats of the Purple Straw type. Most farmers in growing it for the first time have expressed great surprise at the yielding capacity when the wheat was taken off, for the yield invariably exceeded the expectations based on pre-harvest estimates. As a matter of fact, Mr. Farrer's main aim in producing Federation was to produce a variety suited to the Australian methods of harvesting with the stripper. Federation is a short, erect-growing variety of moderate stooling capacity, with broad, semi-erect, light-green foliage. It has short, upright, stiff straw, unaffected by some of the most violent storms. It may be regarded as a variety in which there is a maximum of grain to the minimum of straw. Its chief feature is its extraordinary prolificacy. It was not intended for nor recommended as a hay wheat. It is essentially a grain yielder. It possesses a bold, square, beardless, compact head, with a peculiar and characteristic bronze cast, broad, well-developed, smooth spikelets

As might be expected, there are numerous strains of Federation on the market. In many the original squareness and blocky nature of the head, characteristic of the variety when it emerged fresh from the breeder's hands, have to a large extent disappeared. The effect of rigorous selection in maintaining the yielding capacity of a given variety may be seen by the results at the Longerenong Agricultural College this season.

A small parcel of hand selected Federation (third selection), which was produced by the writer at the Parafield Wheat Station, South

FEDERATION. YANDILLA KING. KING'S EARLY.

Australia, was put in competition with two other Federation plots under precisely similar conditions. Whilst the yield of the hand-selected seed was 43.2 bushels, the two other plots gave 34.5 bushels and 32.8 bushels respectively. Federation is susceptible to fungus diseases—especially rust and flag smut, and, to a lesser extent, "take all" (*Ophiobolus graminis*). Were it a more disease resistant and earlier in maturing, it would be ideally suited for the more arid areas. The grain is very liable to suffer from bleaching, especially in a

showery harvest, owing to the fact that, unlike many of the older wheat varieties, the ear stands upright when ripe, and allows rain to readily penetrate the ear. Its grain is soft, white, and plump, and yields a good percentage of flour of creamy-yellow colour. Though the strength of the flour is considerably lower than Comeback and Bobs, it is higher than the Purple Straw Wheats.*

JONATHAN is another crossbred produced by the late Mr. Farrer, and is of Fife-Indian parentage—*i.e.*, the result of mating Improved Fife with an Indian variety known as "Indian G." It does better in moist cool districts than in hot dry regions. It is a fairly vigorous grower, with moderate stooling capacity, with sparse, erect, glaucous, narrow foliage, and hollow, slender, supple straw. It is fairly rust resistant, and has repeatedly escaped injury from rust when other varieties have been seriously attacked. The head is characteristic in shape, being broad towards the centre and tapering gradually at the summit with white, smooth, beardless, compact, closely adherent spikelets. The chaff adheres closely to the grain, and possesses sharp pointed tips. The grain is hard, and of excellent appearance, and yields a good proportion of flour of high quality and strength. It is a difficult variety to strip, on account of the closeness with which the grain is held.

ZEALAND BLUE.—A cross between Tardent's Blue—a good hay wheat—and Zealand—a variety of the Lammas type—bred by Mr. G. F. Berthaud, of Western Australia, and sent out as Crossbred 53A. It is a tall-growing, medium late variety, with good stooling powers, and strong straw. This variety has done well, both as a grain yielder and hay variety, especially in the cooler wheat areas. The head is long, beardless, slightly tapering, with characteristic velvety chaff. The grain is large, plump, and medium hard, of very attractive appearance, and of good milling quality.

LATE VARIETIES.

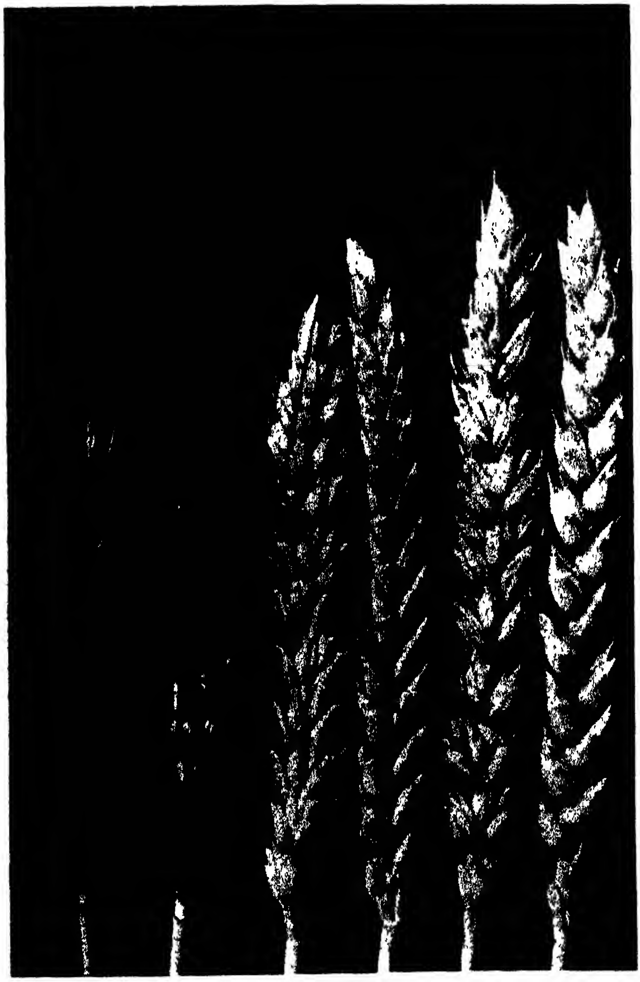
AMERICAN No. 8.—A vigorous tall-growing variety, of good stooling capacity. This was the best of a large number of American varieties grown at the Parafield Wheat Station over a period of five years. It has done well both as a grain and hay yielder, and when thoroughly acclimatised it may prove a valuable variety. It is a somewhat late wheat, with firm, upstanding straw, and characteristic dark-brown heads. The ears are narrow, well formed, beardless, with rather densely packed spikelets, and the chaff very closely adheres to the grain. The grain is small, hard, and dark red, and of good milling quality. Last season a bag of this variety sown at Rutherglen Experiment Farm on stubble land gave 25½ bushels per acre.

GENOA is a late wheat with good stooling propensities and upright straw. It is one of the bunt-resistant crossbred varieties produced by the late Mr. Farrer, and its introduction suggests the possibility that the pickling of seed wheat for the prevention of bunt may in the near future be dispensed with. It does well in seasons when the spring rains are heavy. Thus, at the Rutherglen Experiment Farm last season, a 2-acre plot on stubble land yielded 21½ bags of grain, or 32.2 bushels per acre. It is more suited, however, to cooler districts

* *Vide* Milling Qualities of South Australian Wheats, A. E. V. Richardson, *Bulletin* 52, Department of Agriculture, South Australia.

than hot ones. The ear is long, beardless, slightly tapering, with characteristic rounded widely-spaced spikelets. The chaff is wide and smooth, and the grain soft, white, plump, and mealy.

HUGUENOT.—This wheat was originated by Mr. J. Correl, of Arthur River, Western Australia. Mr. Correl has been responsible for the production of a number of new varieties, most of which are hay wheats. He states that it was obtained in 1897 from a crop of Medeah



MEDEAH. JONATHAN. ZEALAND BLUE.

Wheat, and from the twelve distinct variations he obtained from the variety he selected in 1898. He supposes that his selection must have been a natural crossbred wheat between Medea and Purple Straw. Huguenot is a very tall-growing wheat of the macaroni or durum class, and is quite free from the long, coarse beards characteristic of Medeah. It stands up well, frequently growing to a height of 6 or 7 feet. Its straw is practically solid, and very sweet in character. It is a poor stooler, and must, therefore, be sown very thickly. This

is the more necessary on account of the large size of its grain. Its early growth is erect, and of light-green colour, and the leaves broad and stiff. Unless sown thickly the straw goes up like miniature bamboos. The head is very dense and compact, being dark brown in colour, with a cast of purplish black. The spikelets are densely crowded, and give the ear a club-like appearance. The grain, which is long, hard, horny, angular, and slightly pinched, adheres closely to the chaff, and makes the wheat difficult to strip. This difficulty is

GENOA. FIRBANK. AMERICAN NO. 8.

increased by the fact that the wheat is invariably a tall grower, and possesses very prominent top nodes, which latter often choke the comb of the stripper or havester. It is a macaroni wheat, and not a milling wheat. Its gluten content is high, but the colour of the flour is very objectionable. It is a very poor yielder, and will not pay to grow for grain at f.a.q. rates. It is essentially a fodder variety, being grown either for hay or ensilage. As a hay wheat it gives an exceedingly heavy cut, yields up to 4 and 5 tons per acre being frequent in South Australia. Mixed with varieties like Baroota

Wonder, Majestic, or Calcutta Cape Oats, it gives heavy cuts of good quality sweet hay. It is smut resistant, and relatively rust resistant. The cost of seed wheat of this variety is usually high, but it could not be produced with profit at ordinary f.a.q. rates on account of the low yield of grain per acre.

MEDEAH.—Like Huguenot, this belongs to the Macaroni class of wheats, and is a tall-growing late variety which stools very sparingly. The straw, like Huguenot, is practically solid, but coarse in character, sweet, and bearing prominent nodes. It is difficult to harvest, par-

COMEBACK. THEW. DART'S IMPERIAL.

ticularly when growing rankly, owing to the pendent character of the ripe heads, and the prominence of the last node causing the stripper to choke. It is a very suitable variety to sow for the production of a heavy crop of green fodder or ensilage; but for hay it is rather unsuitable on account of the coarseness of the straw and the heavily bearded heads. The difficulty in harvesting both Huguenot and Medeah may be obviated, particularly where it is liable to grow rank and tall, by sowing it early in the season and grazing the young plants, and allowing the second growth to mature for grain. The heads are compact, the spikelets densely crowded, brown in colour

with patches of bluish black, possessing long, black, serrated beards, and hard, horny, long, and angular grain. The milling quality of the grain is very low. It is essentially a forage variety.

MARSHALL'S No. 3.—This is one of a large number of varieties originated by that successful wheat breeder, Mr. R. Marshall, late of Templars, South Australia. It is a late wheat of good tillering capacity, but rather slow growing when young, with a somewhat spreading habit, and broad, dark-green, drooping leaves. It is somewhat rust resistant, but its late maturity is an objection for the drier districts. The straw, when ripe, has a purplish tinge, stands up well, and bears a beardless, somewhat open head of fair length carrying smooth, broad spikelets, with a slight tip beard. The grain is soft, white, plump, and of fair size, and of fair milling quality. It is very popular in South Australia, New South Wales, and Queensland, and has been very widely grown for hay.

YANDILLA KING.—This is another of Mr. Marshall's crossbred wheats, and is a half-sister to Federation. It was obtained by mating Yandilla and Silver King (a white-strawed variation of Marshall's No. 3.) It is a late wheat, with good stooling propensities, and, like Marshall's No. 3, is a somewhat slow grower in the early stages. The ripe straw is stiff, hollow, and upright, on the short side, bearing large, well-developed, shapely, beardless heads, creamy-white in colour, with broad, close-set smooth spikelets. The chaff adheres closely to the grain and renders stripping somewhat difficult. The ear is slightly tip bearded, and the grain large, plump, medium hard, white, and of good milling quality. It has been a consistently heavy yielder, and has done well in Departmental variety tests, and must be regarded as one of the most prolific grain varieties in general cultivation.

WHITE TUSCAN.—A very popular hay wheat, late, with good stooling powers. Possesses fine quality sweet straw, which retains its colour well when cut for hay. The head is rather open, beardless, white, and possesses a characteristic tapering tip. It gives a heavy cut of good quality hay.

The foregoing list of wheats represents some of the varieties which have done well in various parts of the wheat areas. The list is not intended to be exhaustive, but is intended merely to direct attention to varieties which have been proved to be satisfactory for forage, ensilage, hay, and grain purposes. The number of varieties grown in the various wheat areas under different local names is legion, but careful analysis of the properties and structure of many of these varieties reveals their identity with well-known standard varieties. It is to be regretted that, up to the present, no satisfactory scheme of descriptive classification of the Australian wheats has yet been evolved. Such standardization and classification is a work of the future, and might well be done by the co-operative effort of the State Departments of Agriculture.

Incidentally, it might be mentioned that the production and sale of pure varieties of seed wheat is very rarely a remunerative business. While large incomes have been made by the breeders of high-class stud stock, there are very few men who have profited from the production and sale of new varieties of seed wheat, or improved strains of old varieties. The men who have contributed to the wealth of Australia by the production of new and improved strains of wheat

have not benefited financially from such productions. The reason is obvious. Before a wheat can be popular it must have been tested over a wide area, and proved to be of value in a number of localities. By the time its value has been demonstrated the variety is possessed by many growers, and the monopoly of the variety cannot, therefore, be possessed by the breeder. Moreover, the productive powers of wheat are such that the total produce of one bushel in five years would be sufficient to seed the whole of the wheat area of Victoria.

Most of the State Departments of Agriculture and Agricultural Colleges have taken in hand the production and distribution of selected varieties of graded seed wheat.

A list of varieties of wheat available for distribution by this Department for the seasons 1913 and 1914 is announced in the advertising columns (p. vii).

Obviously, the production of high grade seed is most effective when the seed has been selected within the limits of "pure lines"; that is, the produce of a single typical high grade plant, and continuing the selection on the lines indicated in Article 9 of this series.* Selection on such lines has already been initiated at Rutherglen, Longerenong, and Wyuna, but at least three years must elapse before such seed will be available in bulk for distribution. Meanwhile, such varieties as are available in bulk for 1913 and 1914 are announced elsewhere.

(*To be continued.*)

BEE-KEEPING IN VICTORIA.

(*Continued from page 4.*)

By F. R. Beuhne, Bee Expert.

XII.—NUCLEI.

The word nucleus in bee culture means a small colony of bees taken from a normal colony and established separately in a small hive. The number of bees in a nucleus may vary from 500 to several thousands, the strength of population being regulated by the beekeeper according to the season or the purposes for which nuclei are formed. There are two distinct objects in making nuclei by the division of a stock of bees or of a swarm, one being increase, the other the mating of virgin queens. If the object is increase in the number of colonies, each nucleus should consist of not less than one-fourth of a normal colony, otherwise the end of the season will have arrived before these small colonies have developed sufficiently to winter safely.

For the mating of queens, nuclei are indispensable to the queen-breeder and the modern apiarist, but for this purpose the number of bees in each little hive may be much less, the object being merely to provide a separate habitation for each young queen, with a minimum of worker bees, consistent with taking care of their abode and resisting climatic influences.

In the raising of queens for the purpose of superseding those which are either too old, or otherwise inferior, bee-keepers often encounter

* *Jour. of Agric. of Vic.*, Jan., 1913. Wheat Improvements.

difficulties in any one of a number of methods employed to get the young queens safely laying.

The most direct, but also the crudest and most wasteful way, is to kill the old queen and either let the bees raise cells themselves or supply them with a queen-cell previously raised elsewhere. If the queen killed were old, but had been a good one in her time, the bees may raise a good young queen from her brood, but in the case of an inferior queen no improvement, except in age, need be expected. When a queen-cell of good stock raised under the proper conditions is given, the result will be as good as by any other method, so far as the vitality and prolificness of the young queen are concerned.

In either case, however, there is a considerable loss in the reproduction of the worker-force of the hive, much less certainly, but still considerable, when a cell, ready to hatch within two days, is given. When allowing the bees to raise a new queen themselves after destroying or removing the former queen, it will be at least 21 days before

NUCLEI HIVES FOR MATING QUEENS.

the young queen commences egg-laying; when a cell is given, it will be twelve days during which reproduction is at a standstill. Now, as good queens cannot be raised, excepting under the very conditions which cause brood-rearing to be at its best, it follows that breeding is interrupted just when it should be at the maximum. Even a poor or old queen will at such a time lay 500 eggs per day, representing for 21 days a worker force of 10,500 bees and 6,000 for twelve days, but as young bees continue to hatch for 21 days after the old queen is removed, the weakening of the colony does not become evident till a month afterwards, by which time the circumstances have probably passed from memory.

It is a generally understood fact that there can be only one queen in a hive at a time and, with the one exception referred to further on, that holds good, as, on the average, from the time the young queen hatches till she begins to lay, ten days elapse, and a break in egg-laying for that period must of necessity occur. To reduce this interruption of breeding to a minimum, or to do away with it altogether,

different methods have been evolved and practised, principally by American bee-keepers in the first instance.

The plan which does away with stoppage of egg-laying altogether is to confine the queen to the combs of the lower chamber by means of a queen-excluding honeyboard. About half of the combs of brood are placed in the upper story, to which a separate entrance is provided. A queen-cell is given above and the young queen will take her mating flight from the upper entrance, and in due course will commence to lay while the old queen in the lower chamber still continues. The young laying queen may be removed and used elsewhere and another cell given.

This is an ideal method in theory, but success depends upon a combination of circumstances. These are: a colony covering the combs of two stories; a queen in the lower chamber at least two, but better three years old; and a free use of the upper entrance by the worker bees, otherwise the virgin queen when returning from her mating flight, finding no bees at the upper entrance, will be attracted by the lower one, will enter, and either kill the laying queen or be herself destroyed by the bees.

To reduce the total interruption of breeding to a minimum for the number of queens required, the usual practice is to divide one colony into a number of nuclei of two or three combs, each being given a queen-cell and placed apart from others. Many of the bees will, however, return to the former stand, leaving but young bees behind. These are unable to properly take care of the brood and the queen-cell and to defend the little hive against intruders.

There are several ways of overcoming this difficulty. The bees for each nucleus may be taken from any hive which can spare them; they are shaken into a small empty hive, such as the one shown on the right of the illustration. A wire screen is fastened over the top of the box, and it is placed in a dark, cool, well-aired position. On the evening of the day following, that is, about thirty hours later, the box is taken to the spot where it is to be located. A comb of brood and one or two combs containing honey and pollen are taken (without bees) from some strong colony and given to the nucleus, a ripe queen-cell in a cell protector, or a virgin queen, in an introducing cage, being inserted at the same time.

Another way of making nuclei is to break up into lots of two or three combs each, a colony which has just thrown a swarm. As a number of bees will return to the old stand, only one comb of brood should be left in each nucleus. Select for the purpose those combs containing the greatest amount of sealed brood, and place the combs of young brood in the hive on the old stand, where it will be cared for by returned bees.

A swarm may also be divided into nuclei. It is best to allow it to cluster somewhere; then hive it in an empty box and about sunset divide it amongst a number of nuclei hives, each containing a comb of the brood from which the swarm issued and one or two combs without brood. As bees which have swarmed and clustered will stay in any new stand, a greater number of nuclei can be made out of a swarm than a swarmed stock. The queen of the swarm should, however, be

removed, otherwise the bees are likely to crowd to the particular box she is in.

By any one of these methods from four to ten nuclei may be made out of a single stock, and thus brood-rearing is interrupted only to the extent of one queen for four to ten new queens. In order to still further economize, American bee-keepers some years ago adopted a system of very small nuclei with miniature frames and only a tea-cupful of bees in each. These are known as Swarthmore nuclei. Owing, however, to the liability of such very small hives being robbed out when near an apiary, and the erratic behaviour of these small communities in frequently swarming out, the few Australian bee-keepers who experimented with this system have abandoned it. For the raising of the best type of queen, it is essential that from the first start of the queen-cell to the commencement of laying of the young queen, the most favorable conditions should exist. In the case of very small nuclei these conditions are absent during part of the chrysalis and the adult stage of the queen's life. Even in nuclei on standard combs in thin walled boxes holding two or three frames, the period betwen the hatching and laying of the queen is often unduly extended by climatic influences and the vigour of the young queen impaired.

The influence of extremes of heat and cold may be reduced to a minimum by having three or four nuclei in an ordinary hive body, as shown by the uncovered hive in the centre of the photograph. A ten-frame body will hold four, an eight-frame three nuclei of two combs each. The compartments are made by thin, tightly-fitting division boards, extending upwards to the level of the top of the hive. Each has a separate entrance facing in a different direction and a separate thin cover board independent of the ordinary hive roof.

As it is always desirable to have some spare queens at the end of winter, to make good any losses of queens, these nuclei grouped together in one hive may be carried through the winter, provided there are enough bees in each to nearly cover the combs. When queens have been removed, the divisions may be withdrawn and the bees united under one queen.

Nuclei may be grouped in yet another way by standing, close together, two boxes of two compartments each, as shown in the second hive from the right in the illustration. The advantage of this method is that, after one queen is removed from each box and the bees united, a four-frame super may be put on each, allowing an extension of the brood nest upwards, as shown on the left. When all combs are occupied, an ordinary hive with entrance in the same position may be substituted for the four-frame boxes, the hives moved apart by degrees, and run as independent colonies.

For convenience the nuclei are numbered, the numbers being painted on tablets secured by a nail in the centre and used to indicate the state of each. The number is in normal position for queen laying; upside down, for queenless; diagonal upwards, for queen-cell; horizontal, for virgin; and for queen-fertilized but not laying yet, diagonal downwards.

(*To be continued.*)

CITRUS CULTURE IN VICTORIA.

By S. A. Cock, Orchard Supervisor, Bendigo.

INTRODUCTION.

Fruit-growing in Victoria is rapidly becoming one of the most important industries in the State. The area under cultivation is extending every year with fruits suitable to their geographical situation, and in the northern areas, under irrigated closer settlement, Citrus culture is making such progress that it bids fair to ultimately outstrip all other classes of fruit in area and production. For the benefit of those who are embarking on the production of oranges and lemons, this article will deal with Citrus culture in all its aspects. According to soils, situations, stock, varieties, planting and pruning,

PLATE 1.—INSTRUCTING SETTLERS AT TONGALA ON CITRUS CULTURE.

irrigation, cultivation, drainage, manuring, picking, packing, marketing, and diseases.

SOILS.

The suitability of the soil is a most important feature in connexion with the successful cultivation of the Citrus family. Perfect drainage is an absolute essential. Careful consideration is, therefore, necessary in the selection of a soil for the successful growth of Citrus trees.

The climate of Bendigo is quite as good for the production of the orange as the Murray frontages, but the soil is, in many instances, unsuitable. Bendigo soils generally are deep to fairly shallow, and consist of alluvial and colluvial soils. The subsoil is, in many places, retentive; consisting of red and yellow to grey clays, resting on vertical sandstones and slates, and are depicted in Plate 2, Fig 1. Such soils require perfect artificial drainage. These soils are found as far north as Raywood, Inglewood, and Goornong. North of the places

mentioned, and extending almost to the Murray frontages, and east through the Goulburn Valley, are found soils consisting of a shallow to deep red loam, overlying a retentive red clay of varying depth, lying over layers of silts, grey clays, and gravels. These soils are improperly drained unless the subsoil clay is broken through to the silt layer below. These red clays, however, compact again under irrigation, and can be classed as unsuitable. Plate 2, Fig. 2, depicts this class of soil.

Throughout this area, and all through the Mallee country, are found sand hills or pine ridges. These pine-ridge soils are, generally, most suitable. Areas occur, however, where Citrus culture would prove a failure. These areas consist of soils of a very sandy nature, immediately overlying gravelly washes. These soils drain too freely, and dry out, and can be classed as unsuitable. Plate 2, Fig. 3 represents this class of soil.

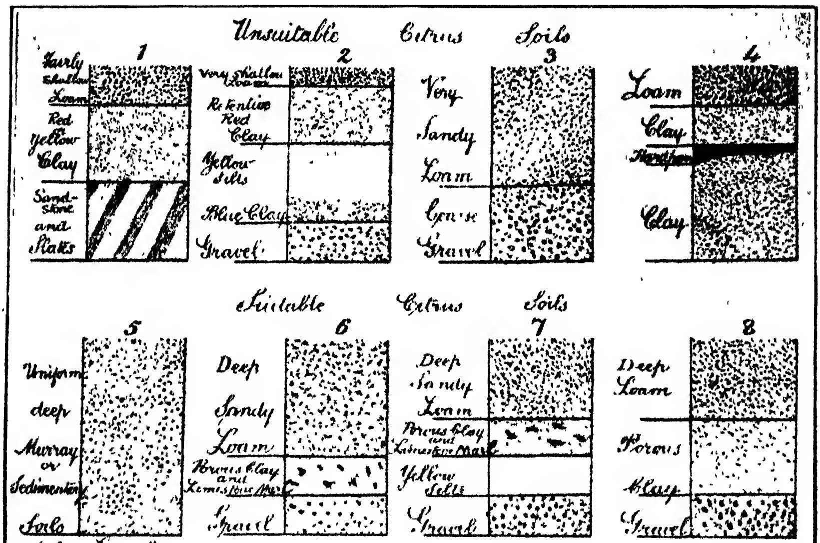


PLATE 2.—SOILS.

Suitable soils are represented by the sedimentary flats of the Murray fringe, the pine-ridge country of the Mallee and the deep loamy soils and porous subsoils of the Cohuna, Bamawm, and Tongala areas—of the first, the composition is all a mixture of clays, silts, and sands, carried by floods from the eroded highlands, and spread on the fringes of the Murray river. These soils are uniform in character and very deep, extending to as much as 20 feet, and overlie a sandy and gravelly drift. They are well drained, extremely fertile, and produce the finest growth of tree and type of fruit in the State. Plate 3 shows orange trees 25 feet high, 25 years old, at the orchard of J. Greenwood, Esq., Koondrook. The tree against which the owner is standing produced this year, 1912, 25 bushel cases of good marketable fruit; last year, 18 bushel cases; and in 1910, 23 bushel cases. At Echuca and Swan Hill the orange on the same

class of soil is equally productive. Plate 2, Fig. 5, depicts this type of soil. Mildura is a name known everywhere. The soils suitable there consist of the typical pine-ridge country of the Mallee. Deep to very deep red sandy soils, generally overlying porous clays, which are in many cases intermixed with limestone marl. These clays sometimes overlie silts, and these in turn overlie gravelly drifts. Mr. J. T. Grossman, of Mildura, in a letter of 18th August, 1912, writes—"*Re* the general feature of the Citrus regarding prolific bearing, the very limy and gravelly soils should be avoided. A stiff land may be made to suit the orange, provided it is well drained and the trees regularly manured, and the character of the soil changed by green manuring. The more sandy and deep loamy soils are the more suitable. They are better drained, and allow deep cultivation." These pine-ridge soils are also found at Cohuna, Bamawm, and Tongala, and

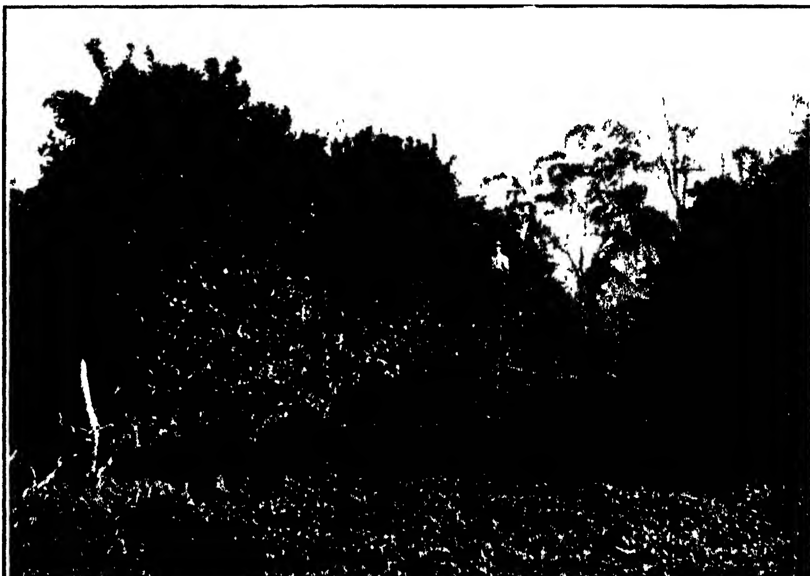


PLATE 3.—ORANGE TREE, 25 YEARS OLD, AT J. GREENWOOD'S ORCHARD. YIELD, 1912, 25 BUSHEL CASES.

they extend right through the Mallee. Their drainage is good, and the type of fruit produced excellent. Plate 2, Fig. 6 represents this class of soil.

Another class of soil found in the northern irrigable areas consists of a deep red loam, overlying a porous clay, intermixed slightly with limestone marl. This porous subsoil overlies a yellow silt, which in turn overlies alternate layers of gravels and silts. This class of soil is distinct from that shown in Plate 2, Fig. 2, as the soil is deeper and more open in texture, and the subsoil is intermixed with sandy particles, which permit of perfect drainage and makes it very suitable for Citrus culture. Plate 2, Fig. 7 represents this class of soil.

Other suitable soils of limited areas may be quoted, such as deep granitic soils, overlying porous subsoils of friable clays, and sedimentary soils overlying gravelly washes along the fringes of creeks and

rivers. Generally speaking, a suitable soil for Citrus culture should be a deep loamy soil, overlying a porous subsoil, which in turn overlies a gravelly wash as shown in Plate 2, Fig. 8. Red soils, as far as my experience goes, do not make any difference in the deeper red colour of the rind. The rich red tinge of the Navel variety appears equally in all the classes of soils indicated in Figs. 5, 6, 7 of Plate 2.

Tests of the subsoil of any area to be planted should always be made before planting, so as to thoroughly understand its character, quality, regularity, and freedom from any hardpan or impervious layers of cements, as shown in Plate 2, Fig. 4. Its porosity can be determined by digging a hole 4 feet square and 2 feet deep, under absolutely dry conditions in the summer months, January or February. The hole should then be filled to the surface level with water, and in two days this water should have thoroughly drained away naturally, if it does not do this, the soil requires under-drainage.

SITUATION.

The aspect of the orchard should be well considered. Citrus trees like a well sheltered and warm situation. The generally flat surfaces of the suitable areas do not lend themselves to much choice, but advantage should always be taken of any eminence. The orchard should be given, as near as possible, a northerly and an easterly aspect, and should be protected from the south and west. The climatic conditions of the north and east are congenial. The cold winds of the south and the west are very severe on young trees, as well as on the young growths of old trees. On the plains of the north frosts are rarely severe enough to do any serious damage. Any fall of temperature below 29 degrees Fah. may injure the lemon, but the orange will withstand more severe conditions of frost. Only on rare occasions have very low temperatures occurred, as can be shown by the following table. Taking the three places named as typical of the climate of the Citrus areas:—

Place	Temperatures for 1910.		Greatest High and Low known	
	Highest Maximum.	Lowest Minimum.	Highest Maximum	Lowest Minimum
Mildura	108°, Dec. 29th	30°, 21st July	123°	23°
Bendigo	105°, 26th Jan	32·8°, 4th June	117°	21°
Echuca	109°, 26th Jan	32·6°, 21st July	115°	23°

In the midlands and the south, although every advantage is taken of soil and situation, the orange produces a fruit of thick rough rind, with much rag, and of poor quality. The lemon does much better, and can be grown, practically, all over the State under congenial soil conditions—Doncaster and some parts of Gippsland being especially favorable. The suitable irrigable areas of the north successfully produce all classes of Citrus fruits.

Under irrigation, and on Closer Settlement blocks, mixed culture is the general practice. Blocks are as a rule small, and the holder has to produce many varieties of produce—lucerne, fodder crops,

vegetables, and fruit. Wherever practicable, suitable areas should be given over wholly to the production of special crops. There should be Citrus areas, deciduous fruit areas, and vine areas, distinct from lucerne areas, and mixed fodder crops. This would modify, to a large extent, the danger of over-irrigation, and under seepage, so injurious to Citrus trees, caused by the laying out of closer settlement blocks on wrong lines. Under intense culture, Citrus trees should be planted on the highest portion of the land. The highest portion is usually the sandiest and best drained, and along the highest points the irrigation channels are brought to command the block.

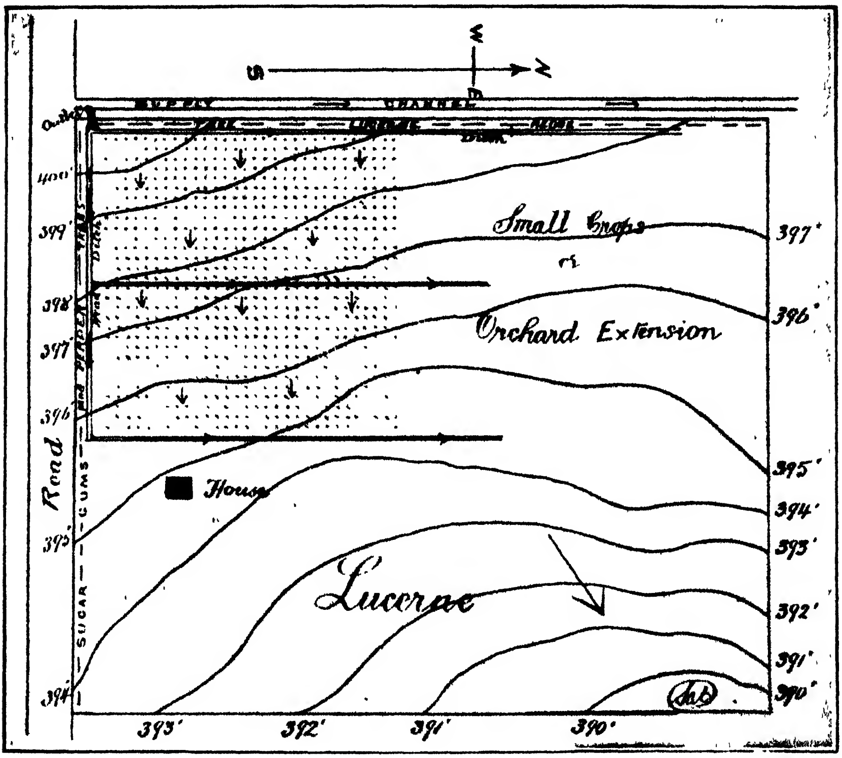


PLATE 4.—PLAN OF IRRIGATION BLOCK, SHOWING 10-ACRE CITRUS ORCHARD PLANTED ON THE SQUARE SYSTEM.

Trees 22 feet apart : scale 10 chains to 3 inches.
Explanatory. Arrows denote flow of water : 400 to 390 contour lines.

Citrus trees require more frequent irrigation than deciduous fruit trees or vines, and, economically, the planting of the highest land with Citrus follows as a natural deduction. Lucerne requires more water than fruit trees, and if planted on the high ground, and the fruit trees planted adjacent to and below the lucerne, under-seepage is likely to occur with great damage to the orchard block. The older irrigators of this State will have recognised these conditions long ago. Plate 4 represents a closer settlement block set out according to soil and situation for the guidance of new settlers.

To shelter the orchard from the south and west it is advisable to aid the situation by suitable wind breaks. Sugar Gums and Pepper trees planted, alternately, at a distance of 20 feet apart will make a suitable breakwind as far as shelter is concerned. The Sugar Gum grows high, and the Pepper tree has foliage right to the ground. These trees should never be planted nearer the orchard than 50 feet. Tagasaste (Tree Lucerne) is most suitable, and can be planted half a chain away from the orchard. It is a quick grower, long lived, makes a dense hedge, and can be trimmed, nor is it a robber of the soil. These trees should be planted in the early spring (August), at a distance of 8 feet apart. Olives can also be used as a breakwind. They do not grow rapidly, but form a valuable adjunct to the orchard, and should be planted 30 feet apart, half a chain away from the orchard. Varieties suitable—Black Italian, Blanquet, Bouquettier, Verdale, Lucca, Manzanillo, Hardy's Seedling No. 1. Cork Oaks (Quercus Suber) could also be used, planted 30 feet apart, and half a chain away from the orchard. They are evergreen, and should eventually be of commercial value for the cork they produce.

(To be continued.)

A CONSIDERATION OF THE CAUSES OF STERILITY IN FEMALE DOMESTICATED ANIMALS.

By G. Heslop, L.V.Sc. (Veterinary Staff).

Sterility may be defined as the incapacity on the part of an animal to reproduce its species. It may be absolute or permanent, relative or transient.

Absolute when fecundation does not take place.

Relative when fecundation occurs only very occasionally, and when development of the young animal is arrested by accident or abortion. A relative sterility may occur in animals in low condition, when, owing to malnutrition, there is imperfect development of ovum in the ovary and absence of sexual desire. It may also occur in fat, obese animals, where there may be fatty changes in the generative organs themselves.

Relative or transient sterility is produced by causes which are removable, and is, therefore, amenable to treatment. Absolute sterility, as the name implies, is incurable.

Fertility in animals is dependent upon normal structure and function of the generative organs, and any abnormality may be productive of either partial or complete sterility.

In order to understand the various abnormalities which may give rise to sterility, it will be necessary to give a short description of the female generative organs. For the purposes of this article these organs may be said to comprise:—(1) the ovaries; (2) the womb; (3) the uterine tubes; and, (4) the vagina.

The ovaries are two bean-shaped structures (about the size of a hen's egg in a mare) situated about a hand-breadth behind the corresponding kidney. They are situated in the abdominal cavity, and are suspended from the abdominal "roof" by a large expansive mass of ligament. They are concerned in the development of ova or eggs at the various periods of "season" throughout the generative life of the animal.

The womb is a hollow muscular sac, which, like the ovaries, is suspended from the abdominal roof by large folds of ligament. It is Y-shaped, being made up of a cylindrical body from which, in front, two horns (right and left) are given off, and these run forward towards their respective ovaries. At the forward termination of these horns, and connecting them up more or less completely with the ovaries, are the uterine or fallopian tubes. These tubes convey the ova or eggs from the ovary to the womb, where, if the ovum is fertilized, further development will take place.

Portion of the hinder part of the womb projects outwards into the cavity of the vagina, and is somewhat constricted where it joins the vaginal wall, forming the so-called os, or neck. In a normally developed os this constriction does not bring about perfect occlusion of the passage between the vagina and the womb, although a very great reduction in the size of the opening is thus occasioned.

The vagina is a tubular passage, about 6 to 8 inches in length in the mare, leading from the neck of the womb, and opening externally.

The generative organs of the domesticated female animal are only in a state of greatest activity during the prime of life. The most notable characteristic of their functions is their quality or state of being regularly recurrent.

Prior to the attainment of puberty the generative organs are inactive and incapable of reproduction; but, when the age of puberty is reached, this period of inactivity gives place to one of periodical activity. This change occurs in both sexes, but is earlier attained in the female than in the male, and marks the animal's arrival at sexual maturity.

The age of puberty is variable and indefinite in that it is controlled by a number of outside influences, such as climate, work, and food. For instance, animals bred in hot countries reach sexual maturity earlier than those animals of the same species bred and reared in cold countries.

With the advent of puberty, changes take place in the generative organs, one of the most important of which changes is the occurrence of Season or Heat. The occurrence of season in animals is dependent upon the attainment of puberty, and upon the development of a ripened ovum in the ovary. It has been shown by experiment that if the ovaries are entirely removed from a female animal by an operation, such as spaying, season will not occur. This is an interesting fact, as it enables us to understand a number of the phenomena associated with some forms of sterility, one of the symptoms of which is total absence of season or heat.

Immediately prior to the appearance of season, an ovum or egg undergoes ripening in the ovary and escapes along the uterine tube, being conveyed towards the womb. If a male and female animal

become mated at this time the egg will become fertilized by one of the living particles contained in the semen of the male. The union of these male and female elements will result in the formation of a new individual, which will subsequently undergo development in the womb of the female until expelled at birth.

PREVALENCE OF STERILITY.

In the absence of statistics it is impossible to arrive at any conclusion regarding the prevalence or otherwise of sterility. In certain individual studs pregnancy and sterility figures have been kept, and these furnish the only information that is available, as far as I can ascertain. As these figures refer principally to pure-bred animals, they cannot be taken to apply generally, as it is a well-known fact that the degree of sterility is greater in pure-bred stud animals than in animals less subjected to artificial conditions of feeding and exercise.

In female animals other than mares it has been impossible to collect any reliable data from which fertility and sterility tables could be worked out.

Statistics furnished by English authorities go to show that from 25 to 30 per cent. of mares used for stud purposes fail to produce foals. I am unable to ascertain if artificial insemination was practised in the studs from which these figures were obtained. In all probability it was not, for figures supplied by one of the large German Studs go to show that the percentage of sterility in that stud was 28 before artificial insemination was practised, and that after artificial insemination was introduced this percentage of sterile mares was reduced to 21 per cent.

The degree of sterility varies in different breeds. For instance, in Great Britain, in Shire mares the average percentage of sterility was shown to be about 37, while in Clydesdales the percentage was about 32, and in Welsh and polo ponies the percentage was about 30.

An examination of the figures available goes to show that an enormous annual loss is occasioned by this high degree of sterility in the larger domesticated animals, and, therefore, any means to remedy the evil will commend itself to breeders.

CAUSES OF STERILITY.

Injudicious breeding and mismanagement.—A great number of cases of sterility have as their casual agent some error in dieting and exercising. " Condition " in an animal intended for stud purposes bears an entirely different relationship to " condition " in an animal intended for slaughter and food. Grossness should never be confounded with good-breeding condition, it being a well-established fact that very fat animals, especially females, often fail to conceive when mated.

Sterility is frequently seen in animals specially prepared for show purposes, where obesity and grossness are often associated with idleness and lack of exercise.

In race-horses there is often noticed a remarkable degree of sterility, especially in females. As these animals are not usually

allowed to breed until after the completion of their racing career, a condition of sexual inertia is established; in addition, the hard, dry food given in a racing stable tends to hold in abeyance the powers of procreation. Such animals, in the majority of cases, require a long spell at grass before they are mated, in order that they may be capable of reproduction. Food, although probably only an accessory cause, exercises a remarkable influence upon the production of sterility. Unbalanced rations containing excesses of foods which are rich in carbohydrates (starch and sugar) are capable of producing varying degrees of sterility; such a food as brewers' grains being especially notorious in this respect. Foods, such as peas, beans, lucerne, and clovers, containing large quantities of nitrogenous substances, are said to increase fertility. This they probably do to a limited extent by increasing sexual desire and assisting in rousing up a sluggish and inert condition of the ovaries to the production of ova and season.

Poverty and overwork are conditions which are often associated, and which tend to lower the fertility of the animal by bringing about ovarian inertia.

The influence upon fertility exercised by age is worthy of consideration. The ability to reproduce the species becomes gradually less as age increases beyond the period of full physical development, until, finally, in old age, the sexual function ceases altogether. Animals which have been mated soon after the attainment of puberty are more likely to conceive than animals which have been kept sexually idle until old age is reached and then mated.

In-breeding exercises an influence upon fertility, it being found that continued in-breeding results in the production of animals possessing varying degrees of barrenness.

Hybrids, such as mules, are generally regarded as being sterile. Cases have been recorded where mules of both sexes have been capable of reproduction, but these cases are exceptional, the rule being that hybrids are sterile.

In mares of an exceedingly excitable temperament it is often noticed that immediately after service the semen is ejected by a series of violent straining motions of the genital organs. In these cases the effect of exhaustive work before service is beneficial. This fact was probably first noticed by the Arabs, as it was a common practice with them, in dealing with excitable mares, to submit them to a fatiguing gallop immediately before service, and afterwards to leave them quietly at rest.

In vicious draught mares, brisk exercise and the pouring of cold water over the hind quarters and loins after service has proved of benefit in preventing the ejection of semen.

Climate, as well as exercising an influence upon puberty in animals, may influence fertility. Animals subjected to sudden changes of climate are often rendered temporarily sterile until acclimatised. It has been noticed that animals are more fertile in countries where the climate is fairly even, and is not subject to sudden extremes of temperature.

In animals affected with chronic debilitating diseases or fevers a temporary and sometimes a permanent sterility is present, in which there is dullness of sexual desire and faulty development of ova in

the ovary. In the treatment of this condition, certain drugs having a stimulating action upon the generative organs are indicated. These drugs include strychnine, compounds of phosphorus, arsenical compounds, and several non-official drugs. Another favorite drug amongst some horse-breeders, but one falling rapidly into disuse amongst veterinarians, is cantharides (Spanish flies).

In the use of any of these drugs for ovarian inertia the breeder should be guided by the advice of his veterinarian, for, owing to injudicious use, they have been responsible for the production of sexual and other disorders more serious in their consequences than those for which they were originally administered.

A large number of cases of sterility have their origin in alterations in, and diseases of, the ovaries. This is especially true of the majority of cases of sterility occurring in cows, where alterations in the ovarian substance are common. These alterations usually take the form of cysts, which, by enlargement and pressure, destroy ovarian tissue and prevent the development of ova. It is not usual for both ovaries to be cystic at the same time, excepting in well-advanced, old-standing cases. Where one ovary is cystic and the other one healthy it is quite possible for the healthy ovary to take up the whole function of production of ova and for the animal to conceive. Usually, however, a cystic condition of an ovary gives rise to irritation in other parts of the genital tract, causing straining and expulsion of the semen at the time of service. The remedy for this condition is surgical, and has for its object the breaking of the cyst wall and the liberation of its contents; or, in some cases, the removal of the diseased ovary and cyst, leaving the normal ovary to carry on the whole function of development of ova.

In pampered, obese animals a condition of fatty degeneration of the ovaries frequently exists. Fat animals are notably infertile, and where fatty changes take place in either the ovaries or the uterine tubes the animal is permanently sterile. Except in the early stages the condition is incurable. Dieting on foods poor in starch, sugar, and fats, together with constant and properly regulated exercise, is about the only treatment likely to have any beneficial effect.

Diseases of the generative organs, such as tuberculosis, and malignant tumors or growths affecting the ovaries, are rare, but when present give rise to sterility. In the case of growths the only effective treatment is surgical removal.

Among sterile mares the majority have at some time in life been pregnant, or have been capable of procreation; the number which have been totally barren throughout life being relatively small. The cause of these cases of sterility in one-time pregnant animals is referable to the previous parturition, at which there was either partial or complete retention of the afterbirth, with or without injuries (abrasions and lacerations) of the genital organs themselves. Retention of the afterbirth is attended with much more serious consequences in mares than in other animals on account of the susceptibility of mares to "blood poisoning" and "founder." Retention of the afterbirth usually occurs in those births in which the expulsion of the young animal from the womb is unduly hurried. It may also occur in cases where birth has been unduly retarded. The semi-attached afterbirth

becomes putrid owing to bacterial infection, and this gives rise to catarrhal conditions of the lining membranes of the womb and vagina. The presence of this catarrh may, in some cases, be demonstrated by the occurrence of discharges of more or less thickened fluid material from the vagina. In the majority of cases, however, owing to closure of the neck of the womb by plugs of catarrhal material the fluid is retained within the womb and no vaginal discharge may be seen. Sometimes a catarrhal condition of the membranous lining of the vagina may co-exist with catarrh of the womb, in which case the discharge is profuse. In chronic catarrh the lining membranes become considerably thickened, and permanent sterility results. Even in mild cases the presence of this catarrhal fluid, which is usually acid in reaction, is fatal to conception on account of its destroying action upon the living elements contained in the sperm of the male. If pregnancy does occur it is usually followed by early abortion. Treatment should consist of frequent flushing of the womb with weak antiseptic and alkaline solutions to destroy the bacteria or germs and to correct the acidity.

Occlusion of the opening at the neck of the womb, which may be present in catarrh of the womb, or may occur as a separate condition, acts as a mechanical barrier to the passage of semen towards the ovum, and fertilization cannot take place. Under normal circumstances when season is present in a female animal there is sufficient dilatation of the os to allow the semen to pass along into the womb and meet with and fertilize the ovum elaborated at this time. Very often occlusion is brought about by injuries, such as tearing and abrasions, received at the time of a previous parturition, when, on healing of these wounds taking place, there is formation of thickened tissue around the os which obliterates the opening communicating between the vagina and womb. Some of these injuries are caused by the straining efforts of the mother in expelling the young animal at birth, while others are produced by the injudicious use of ropes, hooks, knives, and other instruments by persons in attendance upon the mother at the time of parturition. In simple occlusion of the os, unaccompanied by catarrh of the womb or vagina, the treatment adopted should be in the direction of dilating the passage. This can usually be accomplished by passing the hand, previously well oiled, into the vagina and directing it forward until the fingers come in contact with the neck of the womb. By gentle pressure with one finger over the centre of the os, at the same time giving the hand a rotary motion, an opening can be made which can be further dilated by insertion of other fingers until it is large enough to allow the whole hand to pass through into the womb. Perfect cleanliness is necessary in order to insure success. The vagina should be flushed out with weak antiseptic solutions both prior and subsequent to dilation. The hands of the operator should be well washed and disinfected, and the nails trimmed in order to prevent injury to the womb. The use of instruments in order to bring about dilation, in the majority of cases, is quite unnecessary, and, unless used with extreme caution, may bring about fatal results. Their use should not be undertaken by any one other than a qualified veterinarian. In cases of occlusion of the os, the use of the inseminator is of considerable value in bringing about pregnancy.

Abortion is a frequent source of sterility. Two forms of this malady are recognised, namely:—(1) a contagious form, due to a germ which gains entrance at the external genital opening, or through the digestive system; and (2) a non-contagious form. This non-contagious form may be due to a number of causes, the chief of which are—(1) external violence inflicted upon the mother during pregnancy; (2) the action of certain drugs which exert contractile influences upon the muscular structure of the genital organs; (3) ingestion of food-stuffs affected with various forms of moulds or fungi. Commonly associated with abortion is retention of the afterbirth and bacterial infection of the genital tract, also internal injury to the womb, os, and vagina. The relations of these conditions to the causation of sterility have been previously referred to.

Cows which are known as "bullers," and are practically always in season, are invariably sterile, and are suffering from a condition which is incurable. In cows the removal of the ovaries by an operation such as spaying controls to a great extent the morbid sexual desire, thus rendering the animal capable of being rapidly fattened and slaughtered.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

MONTHLY REPORT, ENDED 14TH FEBRUARY, 1913.

By H. V. Hawkins, Poultry Expert.

The results obtained from the Competition Pens during the past month, despite trying conditions existing, were highly satisfactory. On two occasions the thermometer rose above 105 in houses, necessitating the constant use of the hose in the pens and on the birds themselves. Fortunately, no death from heat apoplexy occurred, and the health of the birds is excellent. Two useful showers of rain fell, which helped to soften the ground and put good heart into the birds. Mr. S. Brown's White Leghorns are still well in the lead with a total of 1,318 eggs. Mr. E. Waldon's White Leghorns now occupy second position with 1,246 eggs. Neither pen has had any replacement, and both teams look remarkably fit, though Mr. Brown's are inclined to loosen in feather, which is an indication of moult. It is anticipated that there will be a very close finish between the first three pens.

Feeding.—Care had to be exercised in feeding during the hot weather. On several occasions the mid-day meal was withheld, and the evening grain reduced; wheat being used almost exclusively, and an increased supply of green feed.

Broodiness.—There has been an increased tendency during the last week for the birds to show broodiness, this being attributed to the humid condition that existed, and which hastened many birds into the moult.

The total number of eggs laid up to date is 71,668—an average of 1,038.6 eggs per pen, which must be considered as highly satisfactory.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition. April 15 to Jan. 14.	Jan. 15 to Feb. 14	Total to Date (10 months).	Position in Competition.
40	White Leghorns	S. Brown	1,178	140	1,318	1
20	,,	E. Waldon	1,103	143	1,246	2
47	,,	J. E. Bradley	1,117	118	1,235	3
31	,,	G. Edwards	1,105	124	1,229	4
62	,,	R. W. Pope	1,084	119	1,203	5
28	,,	F. G. Eagleton	1,100	98	1,198	6
25	,,	R. L. Appleford	1,060	135	1,195	7
70	,,	C. J. Beatty	1,053	131	1,184	8
23	,,	W. McLister	1,077	101	1,178	9
37	,,	C. B. Bertlesmeier	1,067	110	1,177	10
1	,,	J. Campbell	1,055	118	1,173	11
39	,,	W. G. Swift	1,032	138	1,170	12
13	,,	W. B. Crellin	1,042	126	1,168	13
33	,,	H. McKenzie	1,017	146	1,163	14
9	,,	J. Spotswood	1,065	94	1,159	15
45	,,	Wooldridge Bros	1,011	140	1,151	16
49	,,	W. Purvis	1,019	123	1,142	17
38	,,	R. Moy	1,010	123	1,133	18
29	,,	J. B. Brigden	1,009	124	1,133	
53	,,	H. Hodges	992	139	1,131	20
63	,,	Percy Walker	983	143	1,126	21
24	,,	Sargenfri Poultry Yards	1,013	107	1,120	22
48	,,	Griffin Cant	1,008	110	1,118	23
14	,,	J. H. Wright	997	111	1,108	24
44	,,	A. W. Hall	981	116	1,097	25
5	,,	J. H. Brain	966	123	1,089	26
7	,,	A. H. Padman	962	111	1,073	27
50	,,	A. Ahpee	980	92	1,072	28
32	,,	S. Brundrett	917	143	1,060	29
6	,,	J. B. McArthur	949	111	1,060	
10	R.C. Brown Leghorns	S. P. Giles	922	137	1,059	31
46	Black Orpingtons	H. A. Langdon	965	94	1,059	
61	,,	Jas. Ogden	955	102	1,057	33
19	White Leghorns	Cowan Bros.	934	123	1,057	
2	,,	B. Rowlinson	956	100	1,056	35
42	,,	Mrs. Kempster	937	117	1,054	36
69	,,	Morgan and Watson	916	134	1,050	37
64	,,	H. Merrick	921	128	1,049	38
15	,,	Mrs. Steer	921	119	1,040	39
35	,,	C. H. Busst	918	121	1,039	40
30	,,	Mrs. Stevenson	918	106	1,024	41
12	,,	T. H. Stafford	881	138	1,019	42
51	,,	H. Hammill	896	111	1,007	43
3	Black Orpingtons	King and Watson	919	87	1,006	44
56	White Leghorns	M. A. Monk	893	111	1,004	45
65	,,	A. H. Thomson	885	105	990	46
43	,,	G. Purton	854	127	981	47
57	,,	B. Walker	843	135	978	48
60	,,	Miss B. E. Ryan	865	110	975	49
66	,,	J. Moloney	833	125	958	50
11	Black Orpingtons	T. S. Goodisson	845	112	957	51
4	White Leghorns	J. Blackburne	831	118	949	52
27	,,	E. Nash	833	109	942	53
54	,,	F. R. DeGaris	843	87	930	54
41	,,	A. Stringer	831	97	928	55
55	Brown Leghorns	J. Matheson	795	125	920	56
16	Silver Wyandottes	R. Jobling	802	115	917	57
68	White Leghorns	W. J. McKeddie	780	122	902	58
8	Black Orpingtons	D. Fisher	813	78	891	59
58	White Leghorns	W. J. Stock	799	76	875	60
21	,,	J. O'Loughlin	757	100	857	61
17	,,	S. Childs	746	106	852	62
52	Minorcas	Chalmers Bros.	783	58	841	63
22	White Leghorns	W. N. Ling	740	96	836	64
67	Anconas	A. E. Manning	743	91	834	65
59	White Leghorns	W. J. Seabridge	721	102	823	66
34	,,	R. F. B. Moore	689	117	806	67
18	,,	B. Mitchell	677	99	776	68
36	Old English Game	K. J. Barrett	670	91	761	69
26	..	(Reserved)	—	—	—	.
		Totals	63,782	7,886	71,668	

GENERAL NOTES.

WESTERN WOLTHS RYE GRASS—

This new grass, said to be a sport from the ordinary Italian rye grass, is an extremely rapid and vigorous grower, and some account of a first year's test with it is given in the *New Zealand Journal of Agriculture.* At Ruakura Farm it surpassed all rye grasses, making a rapid dense growth, and providing excellent spring feed. Sown on 14th May, it was ready for feeding about 1st October. It is said to be superior as a forage crop to, say, peas and oats, because it gives several good after-cuttings. The dairy herd did as well on this grass as on a mixture of peas and oats, and it is suggested that the new rye should provide excellent hay for horses. Being related to Italian, it is not suited for sowing to pasture as it dies out, but its place is that of a forage crop in the rotation. It is adapted to wet districts and good soils, and, as stated, it has the merit of producing several cuts in one season. At the time of writing, 15 tons to the acre was being cut at Ruakura.

THE DAIRY COW—

A cow requires food whether she is milking or not. The amount of food necessary to maintain a dry cow in fair condition, so that she will neither lose nor gain in weight, represents what is called her "maintenance requirement." The maintenance requirement of healthy cows of similar weight does not vary much. If a cow is milking, however, she must consume and digest food in excess of her maintenance requirement. Otherwise she will lose in weight. The food consumed by a cow yielding milk is thus utilized for two different purposes. One part is required for maintenance, and this may be set down as working expenses. The other part is utilized to fill the milk-pail—it is the raw material from which milk is produced. What is a good cow? It is one which can digest and assimilate for milk production an amount of food which largely exceeds her maintenance requirement. But cows vary widely in this respect. From the University of Missouri there comes an interesting discussion of this topic in *Experimental Station Bulletin No. 2.* During two years the herd-testing at the station showed No. 27 cow to be a good milker, and her half-sister, No. 62, a bad one. They were registered Jerseys. In the third year it was decided to compare the food requirements of these cows, and for this purpose both were calved, as it happened, the same week. During the lactation period the food to each was regulated so that the live-weights remained constant, and the amounts of milk and butter fat were then compared with the amounts of food consumed by each cow. In the results it was found that the good milker was consuming about 2½ times as much food, after deducting her maintenance requirements, as did the bad cow, and she also produced about 2½ times as much milk. Altogether, with the good cow, 35 per cent. of the ration went for maintenance and 65 for milk; with the bad one the figures were 56 and 44. Ten bad cows may yield as much milk as five good ones, but they will require twice as much food for maintenance purposes. As it is only the food utilized in excess of maintenance that leaves a profit, the benefits of herd-testing are hereby emphasized.

LUCERNE HAY—

When lucerne is carelessly handled in hay-making there may be considerable loss in weight, and still more in actual feeding value. In *Bul.* 35 of the Colorado Exp. Sta. it is stated that in average lucerne from 40 to 60 per cent. of the crop consists of stems, the balance being leaves. As the hay dries the leaves become brittle, and, together with the finer stems, are easily broken off in the process of hay-making. It is calculated that in Colorado the loss from this cause ranges from 15 to 66 per cent. of the total crop by weight. These leaves are the most nutritive part of the crop. In his standard work on "Farm Foods," Wolff states that in clover the leaves contain more than half the flesh-formers of the whole crop. A similar estimate may safely be assumed for lucerne, and the importance of saving the leaves during haying is thereby emphasized. In making lucerne hay, the crop as left by the mower should be drawn into wind-rows before it reaches the brittle stage, and allowed to dry still more in that position until it is ready for carting. In rows the material will be sufficiently compact to hold most of the leaves when ready to lift, and, moreover, this kind of drying will preserve the colour better. Where a crop has been left too long in the swathe of an afternoon a dewy morning next day will often allow it to be raked together with little loss. On dry bristling lucerne the horse-rake is a bad implement, and it is worst naturally when the crop is light.

FARM COTTAGES—

It is a fact to be much regretted that on very many of the larger farms in this State no provision is made for the housing of married workers. In most districts of England and throughout Scotland all the farms of any considerable size have cottages as part of the regular equipment, and in the men who occupy these cottages the farmers have the best and most reliable of their workers. The married man is the sheet anchor of the British farmer. In Victoria, if a farm worker marries—and it will often be the best who marry—he is practically forced out of the ranks of hired labour. There appear to be three courses open to him. He may give up farm work altogether to take up other work in the city where he can get a house. He may hold on at farm work intermittently by living apart from his wife. In the third place, he may take up a small block on his own account where the returns to his labour will tend to be limited by the capital and appliances at his command. From the point of view of production none of these is a contingency which the farmer as a class can desire; and the want of farm cottages which is characteristic of the State makes it difficult to retain the best class of agricultural labour permanently in the service. Plans and specifications of farm cottages were given in this *Journal* of Aug. and Nov., 1909, and in Jan., 1910, by A. S. Kenyon, C.E., Engineer for Agriculture, and the cost of materials and labour was fully detailed.

THE USE OF PHOSPHATES IN VICTORIAN AGRICULTURE.*

By John W. Paterson, B.Sc., Ph.D., Experimentalist, and P. R. Scott, Chemist for Agriculture.

Phosphorus is an essential constituent of living protoplasm. It is absorbed by plants as phosphoric acid or phosphates, which are highly oxidized compounds of phosphorus and are non-poisonous. Phosphorus is always concentrated in those parts of the plant where cell growth is most active, and is abundantly present in ripe seeds. It is intimately connected with the vital processes of reproduction and growth, and the amount of phosphoric acid removed by crops is more constant than of any other single constituent of crop ash.

Being a mineral constituent, phosphoric acid must be obtained from the soil. In his Presidential Address to this Section (Adelaide, 1907), Dr. Cherry showed that Victorian soils are commonly deficient in phosphoric acid as judged by European and American standards, and a large number of soil analyses were quoted showing that this was so.

The subject has been dealt with by the same author in the *Year-Book of Agriculture* (1905) of this State. Analyses of 186 soils are quoted, and the results are averaged under six distinct types or local groups as follows:—

Phosphoric Acid per 100,000 Dry Soil	
Hill soils (30 samples) ...	63
Northern Plain (34 samples) ..	61
Coastal Plain (85 samples) ...	61
Volcanic soils (24 samples) ...	61
Mallee (5 samples)	47
Drained swamps (8 samples)	76
Average (186 soils) .	62

In his book on "The Soil," Hall quotes analyses of ten typical English soils which average 98 parts per 100,000, which is 58 per cent. above the Victorian average, and also 58 (approx.) above each of the Victorian groups. Maercker (Germany) classes soils as follows in regard to phosphoric acid content:—Poor, 50 parts per 100,000; medium, 50 to 100 parts; normal, 100 to 150; good, 150 to 250; and rich, over 250. Hilgard (America) says that in virgin soil less than 50 is seriously deficient unless accompanied by much lime; sandy loams, with fair supply of lime, 100; sandy loams, with poor supply of lime, 200; and clayey soils not less than 200. According to English, German, and American standards, therefore, it appears that Victorian soils fall seriously below the permissible limit when they are viewed as groups.

The method of averaging soil analyses however is not satisfactory, and while in practice mixing soils has commonly a good effect, as much cannot be said for mixing the figures. We have therefore arranged the above 186 soils showing what percentage of the soils of each local group falls within stated limits of phosphoric acid. The steps selected

* Address delivered at the Melbourne meeting (1913) of the Australasian Association for the Advancement of Science

rise by 10 parts per 100,000 up to 100 parts, then by 50's up to 200, while the few over 200 are classed together.

PERCENTAGE OF SOILS FALLING WITHIN CERTAIN LIMITS OF PHOSPHORIC ACID CONTENT—BY DISTRICTS.

—	Under 10.	10 to 20	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80	80 to 90.	90 to 100.	100 to 150.	150 to 200.	Over 200.
Hill soils (30) ..	..	..	26	10	7	16	10	7	7	3	7	..	7
Northern Plain (34)	..	..	12	3	12	29	12	17	6	3	3	3	..
Coastal Plain (85)	2	8	22	15	11	..	9	5	7	4	11	2	4
Volcanic soils (24)	4	..	4	21	26	8	8	8	..	..	21	..	..
Mallee (5) ..	..	..	20	20	..	20	20	20	..	..	..	..	..
Drained swamps (8)	..	..	13	13	13	13	..	22	..	..	13	13	..
All soils (186)	2	4	18	13	12	10	9	9	5	3	10	2	3

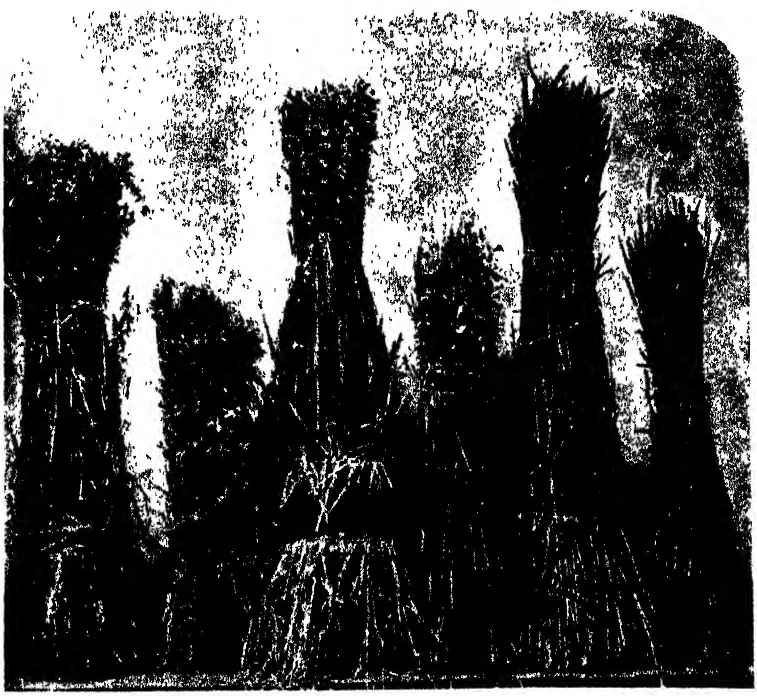


FIG. 1.—SHOWING EFFECT OF SUPERPHOSPHATES ON A FIELD CROP COMPARED TO NO MANURE. (SMALL SHEAVES FROM UNMANURED PLOTS.)

Looking to the totals it is seen that 49 per cent. fall below 50 parts, 36 per cent. fall between 50 and 100, while only 15 per cent. of the soils examined are soils which, as judged by the standard of other countries, might possibly be sufficiently supplied with phosphoric acid.

In a state of nature fertility is never stationary. On good soils it is cumulative; on poor soils it declines. In the earlier settlement of this country the best soils naturally were selected first. These were

well supplied with phosphoric acid, and good crops could be got without the use of manures. In later times the need for adding phosphates to the land has become clearly defined, partly through the depletion of usable phosphoric acid in old soils by continued cropping, but chiefly owing to the gradual extension of cultivation to the medium and poorer soils of the State.

Luckily, within recent years, appreciation of the effect of phosphatic manures has been increasing faster than the growing need for them. According to Returns issued by the Government Statist, 7 per cent. of the area under crops was manured in 1898; 19 per cent. in 1901; 36 per cent. in 1903; 56 per cent. in 1905; 66 per cent. in 1909; and 69 per cent. in 1910. We estimate that from 92 to 95 per cent. of the manures were used to furnish phosphoric acid, being principally dissolved phosphate.

In 1910 the manured area totalled 2,714,854 acres, and the artificial manure used 86,316 tons. This gives an application of 71 lbs. per acre. In 1901 the manured area equalled 556,777 acres, and the artificial manure used was 23,535 tons. This gives an application of 95 lbs. per acre. Farmyard manure increased by 33 per cent. and the cropped area also by 33 per cent. between these two dates, so that there is no reason to believe that farmyard manure was replacing artificials. It appears, therefore, that although farmers have been using artificial manure more extensively they have been applying smaller dressings per acre. It is not possible to reckon from the figures what is the average application made for cereals; but as wheat, hay, oats, and barley at each date together formed 93 per cent. of the cropped area the applications presumably approached within a few pounds of the amounts stated. The relatively small area under green forage, roots, and orchards would be somewhat more heavily manured than the area under cereals.

The phosphatic manures used in Victoria have three sources of origin—(1) imported ready for sowing; (2) raw material imported and manufactured locally; (3) raw materials found locally and manufactured locally. By far the greatest bulk of the material comes under the second class, and a small portion only under the third.

In 1910 there were 24 firms in Victoria engaged in the manufacture of artificial manures, but as detailed returns for manure works other than bone-mills are not available, we may review the manure supply briefly for the Commonwealth. The figures in 1910 were as stated below:—

Exports and Imports of various Manures, 1910.

Commonwealth	Bone-dust.	Guano.	Supers.	Rock Phosphates.	Other Manures.
	cwts.	cwts.	cwts.	cwts.	cwts.
Imports	12,740	788,304	1,196,613	2,112,127	377,327
Exports	80,602	2,812	260,261	11,190	229,841
Excess imports ..	..	785,492	936,352	2,100,937	147,486
Excess exports ..	67,862	..	..	..	..

Imports have increased over 250 per cent. in ten years. The chief items are phosphates. Of bones alone do exports exceed imports. The guano is almost entirely of the insoluble kind, and is used for making superphosphates. Of the manufactured super., over 70 per cent. came from the United Kingdom; Japan and Germany contributed smaller amounts. The largest item is rock phosphate, about 78 per cent. of which comes from Ocean Island, and the balance from Christmas Island. This is entirely used for dissolved manure and superphosphate, and no ground rock practically is used as such. Deducting imports from exports of raw phosphate, and allowing 1.9 ton superphosphate for each 1 ton of rock phosphate and guano, Australia in 1910 manufactured 275,000 tons of mineral super.—which was 85 per cent. of the total quantity employed. The "Other Manures" in the Table is partly made up of nitrogenous and potassic materials which do not supply phosphates.

FIG. 2.—MINING PHOSPHATES, OCEAN ISLAND.

The chief export of manures is from Victoria. Prices in Victoria compare favorably with those of adjoining States, but not so well with prices in Great Britain. The following Table compares the Unit Values of phosphoric acid in Victoria with the figures for phosphate, calculated to phosphoric acid, in Scotland† in 1912.

UNIT VALUES FOR PHOSPHORIC ACID (1912).

Phosphoric Acid as—	Victoria.	Scotland.
	s. d.	s. d.
Water, soluble	4 9	3 10
Citrate, soluble	4 0	..
Fine bone	4 6	3 3
Coarse bone	4 0	..
Insoluble in bone-super. and slag phosphate	3 0	2 6 (slag)
Insoluble in other manures	2 0	..

† *Trans. High & Agric. Soc.*, 1912.

In Great Britain citrate soluble and insoluble are not paid for in mineral superphosphates, but paying for them helps to give a drier manure, which is an advantage. It offers less inducement to use excess of sulphuric acid in making the superphosphate. A common grade of superphosphate in Victoria contains 17 per cent. of water soluble, 1 of citrate soluble, and 2 of citrate insoluble phosphoric acid. At the present time this would sell here at £4 8s. 9d. per ton; on the Scotch Units at £3 5s. 2d. The Victorian price is thus 136 per cent. of that ruling in Scotland. Superphosphate is the manure principally employed in this State, either in its natural state or in bone super., of which the price is largely determined by the price of superphosphate.

Official statistics showed that in 1910 the manured land received 71 lbs. of manure per acre. Seventy pounds of superphosphate to the acre will supply about 14 lbs. of phosphoric acid. In 1910 the Victorian wheat average was 14.52 bushels. A bushel of wheat contains about .48 lbs. of phosphoric acid, and, therefore, the wheat crop of 1910 removed 7 lbs. of phosphoric acid per acre. This would be supplied by 35 lbs. of superphosphate. There are many cropped soils in Victoria which will not grow a crop worth harvesting without manure. We find many notable examples in our work. It cannot be expected, however, that on such soils 35 lbs. of super. will produce 15 bushels of wheat, provided the other conditions are right. The straw will require the equivalent of 10 lbs. manure; and in no case can the manure applied be wholly absorbed by the first crop. At Rothamsted, 36 per cent. of the phosphoric acid used was recovered in the mangel crop, but we have no figures as to the maximum utilization possible by wheat on poor soils. The method of drilling is favorable to absorption, but probably this never reaches 50 per cent. It will generally be less. It is fortunate, therefore, that the amount of manure necessary to give the largest profit must incidentally contribute to the enrichment of the soil by what the crop is physiologically unable to utilize. This places the phosphate supply of cultivated soils on the up-grade.

An acre of soil to a depth of 1 foot will weigh about 3,500,000 lbs. Taking 64 lbs. of phosphoric acid per 100,000 of soil (an average amount), this would equal exactly 1 ton per acre. If 70 lbs. superphosphate be applied per acre, to allow for 50 per cent. of absorption by a 15-bushel crop, then 320 years would be required to double the phosphoric acid content of the soil. The effect seems trifling. As is well known, the manurial residue, however, is more valuable than the native soil phosphate because, particularly if applied in soluble form, it is thinly spread out. This effect is enhanced when the first rains after drilling are heavy. Farmers say their land grazes better when the preceding crop was well manured.

In Britain it is common to apply up to 4 cwt. superphosphate to cereals, and up to 8 cwt. for roots. The manure is generally sown broadcast. This practice is calculated to soon enrich the soil in a sensible degree. In Victoria such large dressings are not profitable with cereals. It will seldom pay to apply much over 80 lbs. of superphosphate to a cereal. The difference may be partly due to climate, but it is probably due in larger measure to the Australian method of

drilling in with the seed. This method has certain advantages, and is doubtless the best means of employing manure in small quantities. It does not follow, however, that it is a safe guide as to the best quantity of manure to apply, except in cases where the manure is left in contact with the seed. For each quantity of manure there is doubtless a best method of applying it, and the subject is one for systematic investigation. Will 140 lbs. of manure placed 2 inches below the seed give a better net return than 70 lbs. applied at the same depth as the seed; and will the former crop be deeper rooted, and stand dry weather better? That the land will graze better later does not admit of doubt; and that the phosphate supply of the soil can be increased by a method of application admitting of heavier dressings with profit follows as a matter of course. Victorian soils are for the most part highly deficient in phosphates, and the incidental results which will follow the discovery of a method whereby heavier applications of manure can be made immediately profitable to the farmer are, we might say, of national importance.

Looking to the beneficial effect of phosphates upon cereals, even on virgin soils, it is remarkable that almost no attention is given to the manuring of pasture grasses. Being generally shallow-rooted, their needs are presumably the greater. More particularly on second class land devoted to dairying might a good return be expected from a moderate application of phosphates.

(*To be continued.*)

FERTILITY OF WHEAT LANDS—

Fallowing is an excellent means of storing up soil moisture and cleaning the land, and on this account it pays for doing. But in the long run the wheat-fallow-wheat system can only be viewed as a temporary expedient. Where it is well done, the soil is seriously depleted in organic matter by fallowing. In California the conditions somewhat closely resemble those of our own northern areas, but cultivation is of older date, and the experience of California, therefore, is for us fully significant. The subject is dealt with in an exhaustive *Bulletin* (211) issued by the State University. "Continued grain culture under shallow preparation over a long period has seriously affected the naturally low humus supply of the grain lands of California. This condition has been rendered worse by the burning of the straw and biennial culture necessitated by a limited rainfall. Humus in ample quantity in a soil means success; its lack means disaster, and this is particularly true in dry-land farming." The *Bulletin* quotes a number of experiments, showing the excellent effect of ploughing in green manures as preparation for wheat, and states that the wheat yield of California can be doubled by following this system, coupled with deeper cultivation. As ploughing-in crops, rye is recommended as a start, to be followed later by an admixture of rye and peas, or vetches, when a foundation has been laid. Rye has been found the surest. "Whatever crop is used it should be seeded as soon as it is possible to shallow-plough or disc the land in autumn, and the crop should be turned under in early spring, before the land is too dry for deep ploughing, and while it is still moist enough to start humification, or decay of the material ploughed in."

REPORT ON THE EXPERIMENTAL POTATO FIELDS, 1911-12.

By Geo. Seymour, Potato Expert.

During last season this work was carried on at a limited number of centres, as the blight caused a large decrease in the amount of available seed. Variety tests were carried out at the following centres:—Tourello, Pootilla, and Alberton.

Also at Leongatha, for the purpose of testing the relative resistance to Irish Blight of different varieties. Two plots were also established for manure tests exclusively—one at Daylesford and one at Romsey.

Table I. shows the plan of the plots at Pootilla, Tourello, and Alberton. Table II. shows the plan of the plots at Romsey and Daylesford.

TABLE I.

Plan of Experimental Plots at Tourello, Pootilla, and Alberton.

Variety and Manure Tests.

5 chains.

2 chains.	Thomas' phosphate, 265 lbs. per acre.	No manure.	Thomas' phosphate, 265 lbs. per acre.	Superphosphate, 224 lbs per acre.	No manure.	Superphosphate, 224 lbs per acre

TABLE II.

Plan of Plots at Romsey and Daylesford.

Artificial Manure Tests.

1	2	3	4	5	6	7	8	9	10
Superphosphate, 224 lbs per acre.	Thomas' phosphate, 265 lbs. per acre.	No manure	Blood manure, 140 lbs.	Sulphate of ammonia, 112 lbs. per acre.	No manure.	Sulphate of potash, 112 lbs. per acre.	Kainit, 336 lbs. per acre.	Superphosphate, 224 lbs Sulphate of potash, 112 lbs. Sulphate of ammonia.	Sulphate of ammonia, 112 lbs. Sulphate of potash, 112 lbs

The plot at Leongatha was manured with a dressing of superphosphate at the rate of 224 lbs. per acre with an unmanured check section.

TOURELLO.

The season was very unfavorable for heavy yields, being unusually dry during the tubering period. The field at Tourello was on fairly good potato land. The varieties used in this plot may be divided into two classes, *i.e.*, white skins and red skins; the former represented by Clarke's Main Crop, State of Maine, and Cruffle; the latter, a variety now largely grown in Gippsland, which promises to be a useful addition to the main crop sorts of this State. Last season it stood the disease in the Leongatha plot, and has proved itself a consistent cropper under all conditions. Of the other varieties, Clarke's Main Crop gives fairly steady yields; State of Maine is a medium-early variety, the crop was planted on the 16th November, and on 24th January (ten weeks afterwards) the plants of this variety were carrying tubers of a considerable size, and by the 1st March were fit to harvest.

TABLE III.

MR. J. A. TROUP'S PLOT, TOURELLO.

Variety	Thomas' Phosphate						No Manure.						Super-phosphate.						No Manure.					
	Market-able			Small			Market-able			Small			Market-able			Small			Market-able			Small		
	tns.	cwt	lbs.	tns	cwt	lbs	tns.	cwt.	lbs.	tns.	cwt	lbs.	tns.	cwt	lbs.	tns	cwt	lbs.	tns.	cwt.	lbs.	tns.	cwt	lbs
B River	2	3	84	0	11	16	2	6	50	0	12	33	1	8	33	0	9	8	1	4	16	0	13	74
Cop Skin	2	5	85	1	1	9	2	13	11	0	19	14	1	18	28	1	1	9	1	4	66	1	1	96
Black Prince ..	2	5	85	0	18	49	2	10	67	0	13	74	2	5	84	0	15	3	1	10	6	0	12	33
Old Pinkeye .	2	7	91	1	4	66	2	3	86	1	4	66	1	16	22	1	5	107	1	10	6	1	7	36
Scruffle	3	6	105	1	4	66	3	4	23	1	4	66	3	2	69	1	7	36	1	18	28	1	7	36
C. Main Crop .	3	4	23	1	4	66	3	0	12	1	4	66	3	4	99	0	17	85	2	17	42	0	15	3
State of Maine .	2	15	56	0	3	100	2	6	22	0	4	89	2	11	67	0	4	56	2	3	22	0	4	22
	2	12	91	0	18	44	2	12	5	0	17	74	2	6	89	0	17	27	1	15	49	0	17	42

The returns obtained from the red skins go to show that these varieties have had their day, as far as the old potato districts are concerned.

POOTILLA.

The plot at Pootilla was on a light, gravelly, buckshot soil, not typical of the potato land in this district. The main, indisputable feature of this plot is the effect of the manures. The dressing of Thomas' phosphate resulted in an increase of 9 cwt. 25 lbs. per acre, whilst the super of the same value only increased the yield by 1 cwt. 84 lbs. The soil of this plot was of a very even character, as shown by the returns from the unmanured section, which was in favour of the phosphoric acid section.

ALBERTON.

The most satisfactory returns were obtained on the Alberton plot. The soil is alluvial river flat. Twelve varieties were planted in this plot, amongst them were the following red skins:—Brown's River and

Black Prince. These are two varieties very suitable for export. Over 8 tons per acre were obtained from the Brown's River, and a slightly better yield from the Black Prince. This class of potato has almost disappeared from the old districts, as it no longer gives satisfactory returns. Further experiments are contemplated in the coming season at the Alberton plot, and, should these returns be confirmed, it will point to the fact that the cultivation of these varieties would pay handsomely, as there is always an assured market for shipment to other States.

Table IV.

Mr. Ibbott's Plot, Pootilla.

Name of Variety.	Thomas' Phosphate.						No Manure.						Superphosphate						No Manure.					
	265 lbs. per Acre.						..						224 lbs. per Acre.						.					
	Marketable.			Small.			Marketable.			Small.			Marketable.			Small.			Marketable			Small.		
	tns.	cwt.	lbs	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt		tns	cwt.	lbs.	tns.	cwt	lbs.	tns.	cwt.	lbs.
Up-to-date .	1	4	76	0	17	46	0	18	33	0	5	78	2	1	58	0	16	8	0	16	8	0	8	4
N.Z Pinkeye .	2	1	88	1	0	10	1	12	16	0	10	78	1	14	96	0	9	40	2	0	2	0	13	44
Clarke's Main Crop	2	8	21	0	12	6	1	10	15	0	17	46	1	6	88	0	16	8	1	6	88	0	13	44
Brown's River ..	2	8	21	0	14	82	1	16	8	0	10	78	1	13	54	0	14	82	1	4	12	0	10	78
Wilson's Premiers	3	4	106	0	18	83	1	17	56	0	16	8	1	17	56	0	16	68	1	12	16	0	10	78
Green Mountain ..	0	18	83	0	3	60	0	9	40	0	2	76	0	6	78	0	4	2	0	8	79	0	1	38
Adirondack ..	1	16	93	0	14	7	0	17	46	0	10	78	0	14	82	0	11	43	0	14	17	0	12	6
Chancellor .	2	4	24	0	10	78	1	2	86	0	8	4	1	4	12	0	6	78	1	4	100	0	5	38
Brownell's Beauty	0	14	82	0	8	4	0	8	4	0	6	78	0	11	43	0	9	4	0	10	78	0	6	78
Sutton's Abundance	2	6	38	0	18	10	2	13	66	1	2	86	1	15	48	1	4	100	1	19	32	0	16	97
Copperskin .	1	12	6	0	10	78	1	6	88	0	13	44	1	16	8	1	0	10	1	6	88	1	6	88
State of Maine	1	13	54	0	10	78	1	6	88	0	13	44	1	16	8	1	12	6	1	4	12	1	6	88
White Prolific ..	2	0	2	1	3	44	1	2	86	1	2	86	1	16	8	1	3	44	1	6	88	1	2	86
Foxe's Seedling ..	1	15	54	0	14	82	1	4	2	0	10	78	1	10	90	0	13	44	0	18	33	0	10	78
Average ..	1	17	93	0	14	7	1	6	13	0	9	45	1	8	104	0	9	94	1	3	94	0	13	28

Leongatha.

This plot was established for the purpose of testing the resistance to Irish Blight of different varieties. Thirteen different varieties were planted; but, in consequence of the very dry season, the Blight did not make its appearance, therefore no information was obtained on this point. As before stated, this plot was dressed with 2 cwt. of superphosphate per acre, with a check section without manure. This moderate dressing of phosphoric acid, costing about 9s. per acre, increased the yield by over 13 cwt., which, at the market price at the time of harvest, was worth about £4. It should also be stated that the average sample from the manured section was much superior to those in the unmanured. This plot was on lea ground, having been under grass for some years, and, as often happens with such land, the crop was attacked by Eel Worm. It is interesting to know that the manured section was very free from the disease, whilst the unmanured land was badly affected, the difference amounting to quite 50 per cent. If these results are confirmed by future experiments, it will prove worthy of the attention of growers who have had trouble

from this pest, notwithstanding the fact that it is advisable to take a crop of oats or maize off a field before using the land for potatoes.

ARTIFICIAL MANURES.

Daylesford and Romsey.

The decline in the yield of the potato crops in the older districts of this State makes the question of manures a pressing one. Every grower knows well that farmyard manure is the best, because, in addition to supplying all the necessary ingredients of plant food, it has a beneficial effect on the mechanical condition of the soil on account of the organic matter it supplies; but the difficulty is to get sufficient of this material to cover any considerable area, consequently artificial manures are resorted to. These have many points to recommend them, such as the saving of time and labour, as with the ordinary seed drill 7 or 8 acres per day can be dressed. An ordinary dressing of dung entails an enormous amount of heavy work, as about 80 per cent. is water. A 16-ton dressing contains 144 lbs. nitrogen, 66 lbs. phosphoric acid, 132 lbs. potash, and 282 lbs. lime.

Table V.

Alberton Plot.

Variety.	Thomas' Phosphate 262 lbs per acre						No Manure.						Super-phosphate. 224 lbs. per acre.						No Manure					
	Table.			Small.			Table			Small.			Table.			Small.			Table.			Small.		
	tns.	cwt.	lbs.	tns.	cwt.	lbs.	tns.	cwt	lbs.	tns.	cwt.	lbs.	tns.	cwt	lbs.	tns.	cwt.	lbs.	tns.	cwt	lbs.	tns.	cwt.	lbs.
Green Mountain	9	3	84	1	2	0	5	16	28	1	2	56	9	7	56	1	10	0	8	12	0	1	2	56
Sutton's Abundance	5	3	28	0	9	42	4	8	14	0	13	34	6	12	0	0	11	28	5	6	96	0	11	28
Brown's River .	8	8	4	1	6	28	8	4	100	0	7	56	8	16	28	1	2	56	6	11	26	0	11	28
Black Prince	8	10	26	0	15	0	11	8	84	0	18	84	9	3	80	0	16	95	9	16	10	0	18	84
Carman	3	1	88	0	6	56	4	10	0	0	7	28	6	0	0	0	6	56	6	18	84	0	15	0
Burbank . .	8	6	35	0	10	68	6	18	32	0	15	0	6	12	21	1	2	56	6	15	0	1	2	56
Adirondack ..	8	18	70	0	8	90	5	18	14	0	18	84	9	1	84	0	13	24	4	10	0	0	18	84
Foxe's Seedling .	6	3	84	1	0	84	3	15	0	0	11	28	5	14	4	0	13	24	4	19	42	0	11	28
Clarke's Main Crop .	6	13	24	0	16	95	6	18	84	0	15	0	7	11	84	1	2	56	5	5	0	0	8	90
Wilson's Premiers ..	5	1	28	0	8	90	4	17	28	0	7	28	6	8	48	0	15	0	5	1	28	0	8	90
Snowflake	4	17	56	0	7	28	3	18	34	0	3	70	4	17	56	0	7	28	3	7	28	0	7	28
Old Pinkeye ..	2	18	14	0	15	0	1	17	56	0	11	28	3	3	56	0	15	0	1	17	56	0	11	28
Averages ..	6	8	91	0	13	15	5	13	104	0	12	31	6	2	43	0	16	72	5	15	2	0	13	106

There are several factors controlling the action of artificial manures, but it depends chiefly upon an ample supply of moisture. This sometimes depends upon—

1. Climatic conditions, such as a bountiful rainfall during the growing period, or a cool moist region where the evaporation is low.
2. Soil conditions—
   (*a*) bottom land, which is often saturated in winter;
   (*b*) a retentive subsoil;
   (*c*) previous methods of cultivation, especially when pasture is included in the rotation.

Table VI.

Leongatha Plot.

Name of Variety.	Superphosphate. 224 lbs. per acre, 9s						No Manure.					
	Marketable.			Small.			Marketable.			Small.		
	tns.	cwt.	lbs.	tns.	cwt.	lbs	tns.	cwt.	lbs.	tns.	cwt.	lbs
Early Northern	2	6	74	0	17	98	1	7	45	0	5	0
Champion . . .	3	4	102	0	8	54	1	14	7	0	11	74
Commersoni Violet	0	17	43	0	2	51	0	11	66	0	3	83
Burbank	1	10	72	0	5	89	2	5	86	0	15	0
Early Fortune	2	1	101	0	3	9	0	18	8	0	4	56
Cruffle .	3	0	0	0	4	84	0	4	56	0	10	56
Adirondack . ..	1	15	16	0	4	0	0	19	32	0	8	4
State of Maine . ..	1	17	5	0	5	24	1	4	42	0	2	56
Up-to-date .. .	2	11	40	0	5	16	2	11	40	0	14	0
Green Mountain .	0	10	80	0	0	64	1	16	0	0	0	64
Sutton's Abundance .	1	8	44	0	5	22	0	13	81	0	5	45
Clarke's Main Crop	2	2	54	0	3	8	0	16	98	0	4	42
Wilson's Premier .	2	8	44	0	3	8	1	2	21	0	7	21
Snowflake ..	1	17	80	0	6	96	1	6	48	0	6	48
Averages . .	2	19	53	0	5	44	1	5	13	0	7	7
	0	5	44				0	7	7			
	3	4	97				1	12	20			
Gain							1	12	77			

Table VII.

Section	Quantity and Manure used.	Cost per Acre			Daylesford Yield per Acre			Romsey Yield per Acre		
		£	s	d	tns	cwt.	lbs	tns	cwt	lbs
1	224 lbs. superphosphate .. .	0	8	9	5	1	20	2	12	76
2	265 lbs. Thomas' phosphate	0	10	0	5	7	56	2	12	76
3	No manure		.		4	17	56	3	0	60
4	140 lbs. blood manure	0	7	6	5	2	56	3	5	70
5	112 sulph. amm.	0	15	0	5	2	56	3	15	0
6	No manure		.		5	2	56	3	7	106
7	112 sulph. potash	0	14	4½	7	10	28	3	7	71
8	336 kainit	0	15	0	6	12	56	3	6	108
9	224 lbs superphosphates .. 112 lbs. sulph. potash .. 112 lbs. sulph. amm . .	1	18	1½	7	1	28	3	11	28
10	112 lbs. sulph. amm. .. .. 112 lbs. sulph potash .. .	1	9	4½	5	2	56	3	1	18

One noticeable feature of these plots was the vigorous growth of the plants on all the sections manured exclusively with a dressing of phosphoric acid, which was only surpassed by the sections receiving a dressing of sulphite of ammonia. The yields of these sections in the Romsey plot were not in keeping with the early growth of the plants, whilst in the Daylesford plot the beneficial action of the phosphoric acid is evidenced by the increased yield, the only difference in these plots being the rotation practised. The Daylesford plot was comparatively new land, whilst that at Romsey had been constantly

under cultivation for fifty years, and was lacking in humus, consequently very liable to dry out in the summer. The function of phosphoric acid in plant growth is to hasten maturity. In a wet season or on moist soils phosphoric acid will increase the yield, and in a dry season on land that dries out quickly it will decrease the yield.

TABLE VIII.

COMPARATIVE RETURNS—THOMAS' PHOSPHATE AND SUPERPHOSPHATE.

Manure ..	Thomas' Phosphate.	No Manure.	+ Increase.	Superphosphate	No Manure.	+ Increase
Weight .	265 lbs. per acre	Nil	− Decrease	224 lbs. per acre	Nil ..	− Decrease
Cost	10s. ..	Nil	..	9s. 6d. .	Nil .	.
Plot	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.	tns. cwt. lbs.
Tourello .	3 11 23	3 10 0	+0 1 23	3 4 4	2 12 91	+0 11 25
Pootilla	2 11 100	1 15 58	+0 16 42	1 18 86	1 17 10	+0 1 76
Alberton	7 1 106	6 6 23	+0 15 83	6 19 3	6 8 108	+0 10 7
Average	4 8 39	3 17 27	+0 11 12	4 0 68	3 12 107	0 7 73

NEW SEEDLING VARIETIES.

A parcel of pedigree seed was received from Dr. Wilson, St. Andrew's, Scotland, who visited this State with the Scottish Commission. It comprised six different crosses, most of which are the result of working a red-skinned variety, sent to him from New Zealand, on a number of British sorts. They were as follow:—

No. 88.—Main Crop (3), New Zealand variety (2).
No. 99.—Up-to-date, a New Zealand variety (2), Myatt's Kidney, Main Crop.
No. 128.—British Queen, Myatt's Kidney, Main Crop (2), New Zealand variety (2).
No. 139.—Main Crop (2), New Zealand variety (2), Myatt's Kidney.
No. 155.—Cramond Blossom, Main Crop, New Zealand variety.
No. 177.—British Queen, Main Crop, New Zealand variety.

A few seeds of each variety were planted on 23rd February, in pots. Germination was very satisfactory. The plants were removed from the pots on 6th April, and planted in a well-prepared garden plot. Early autumn frosts and dry weather interfered with the growth, with the result that the tubers produced were very small. No definite information can be formed as to the value of these new varieties for a season or two. It may be stated, however, that the flesh of most of them is yellow. By 1st June, all the plants except Nos. 155 and 177 had ripened off. The two latter appear to be very hardy plants. They resisted the frosts better than the others. The

whole of the plants were lifted on 27th June, when the following particulars were noted:—

No. 88.—Tubers round, colour white, late maturing, stolons long.

No. 99.—Tubers round, colour of potato white, medium early, stolons long.

No. 128.—One plant tubers, kidney shape, all others round, white, early.

No. 139.—Tubers all kidney shape, white, early, stolons very short.

No. 155.—Tubers round, white, late, vigorous plant, resisted frost.

No. 177.—Tubers all aerial, white, very late, vigorous plant, resisted frost.

LOCALLY RAISED SEED.

A small parcel of seed was saved from a field of potatoes grown by Mr. Scott, of Noss, near Casterton. The crop on this field was remarkably free from blight. The following plants belonged to a very productive strain, and showed remarkable resistance to blight. This seed was kindly grown by Mr. Thomas Pocket, Malvern, and from it 70 plants were obtained. Three of these did not produce any tubers, 6 showed a very stringy growth, 31 were rejected on account of undesirable features. Thirty, however, produced potatoes that were regarded as having desirable features. Of these, 7 were apparently early, 16 mid-season, and 7 late. Some were carried on long stolons, and others were produced quite close to the stems. One desirable feature of this parcel is that the whole of the varieties are very white in the flesh.

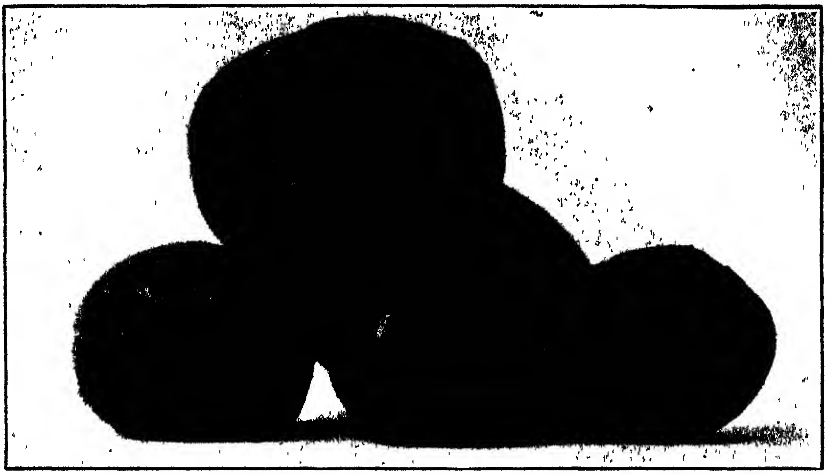
REPORT ON DISEASES.

Potato crops were generally very free from disease of all kinds. In the early crop a little Irish Blight was noticed towards the end of October; but very dry weather set in and checked the spread of the disease, and, owing to a very dry summer and autumn, the late crops were quite free from the blight.

Potato Moth.

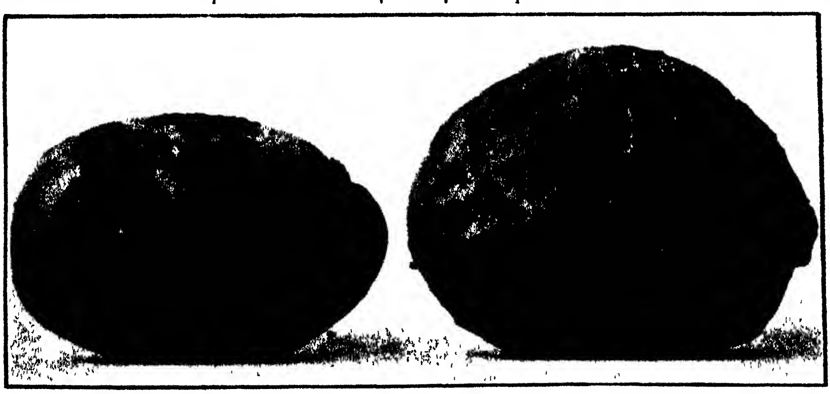
More damage was done during 1911-12 by the potato grub to the mid-season crop than by the blight in 1910-11. In some cases it amounted to fully 50 per cent. No satisfactory method has yet been devised for coping with this pest. The use of tarred canvas screens to trap the moth when on the wing, and spraying with arsenical preparations, are recommended. The latter will probably give the most satisfactory results if commenced in time. In many cases where the crop was lifted before the plants dried off, tubers which were apparently sound when put into the bags and covered with green tops, when the sap dried out of these, the grubs forsook them and attacked the tubers in the bags, which are often left in the field for a week or ten days. The result was that when the tubers reached the market they were found to be so badly tunnelled with the grub that from

50 to 75 per cent. were unfit for use. Deep planting has been recommended—5½ to 6 inches; but this of itself is not sufficient, as it is the habit of some varieties to form their tubers near the surface. The best protection is, probably, fairly deep planting and thorough moulding of the plants. If the moth appears in the field, this should



SCABBY TUBERS.

be done as soon as the tubers are well grown. To get satisfactory results from moulding, the drills should be not less than 30 inches apart. If the tubers are large enough for table use they should be harvested and disposed of as quickly as possible. If intended for



SCABBY TUBERS.

seed, it would be advisable to dip them in a solution of corrosive sublimate (1½ ozs. to 7 gallons of water) for one hour and a half.

SCAB AND EEL WORM.

The question of scab and eel worm has, in the presence of Irish Blight, been almost lost sight of; but these diseases will force themselves on the attention of growers, especially those who desire to keep their fields clean. The treatment recommended for the various forms

of scab due to the attack of fungus diseases is that of dipping the potatoes in corrosive sublimate or formalin. It is to be regretted that many growers are not inclined to go to the trouble because they see a neighbour who does not treat his seed have a clean crop. This often occurs, in spite of the most striking evidence of the benefit of dipping. The results of some experiments made in 1909-10 were recorded in the *Journal of Agriculture,* June. 1910. These experiments were continued during the following season (1910-11). The pots were put aside after lifting the tubers in 1910. The soil was not interfered with in any way, and in November, 1910, a clean Carman potato which has been dipped in formalin for two hours was planted in each pot, Nos. 1, 2, and 3. The produce of these was harvested in February, 1911. The following results were recorded:—No. 1, all tubers perfectly clean. No. 2, all tubers more or less scabby. No. 3 (duplicate of No. 2), all scabby. It. was not intended to carry these experiments any further, but in the spring of 1911 it was discovered that a tuber had been left in each pot. The produce of these was harvested in February, 1912. The accompanying photographs will show that the results of the previous season were repeated.

SPRAYING FOR BLIGHT.

The results from spraying are dealt with in a separate article in the *Journal of Agriculture,* December, 1912.

THE FRUIT TRADE OF VICTORIA:

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page* 123.)

PART V.—OVERSEA EXPORT TRADE.

By E. Meeking, Senior Fruit Inspector.

PROBLEMS AFFECTING THE KEEPING OF FRUITS.

The unsatisfactory condition in which a large proportion of our fruits arrive on the British and Continental markets, and the consequent loss which results from this each season, has furnished much subject-matter for controversy amongst growers, shippers, and others interested during the past few seasons. Many theories have been advanced as to why our fruits deteriorate during transit. Some of the disputants, for instance, aver that want of due care on the part of the shipping companies in the matters of carrying the fruit at too high a temperature, and also of permitting the temperature to fluctuate during transit, the lack of providing insulated chambers for the fruit taken on at each port, the rough methods of handling by stevedores (both at this end and at the port of destination), the neglect on the part of the Railway Department to provide suitable cool-car accommodation for conveying the fruit from the orchard to the port, are each responsible for the unsatisfactory results. The great fault has been that, in most instances, those concerned have confined their

arguments to one aspect of the case only, and appear to consider that one of the factors mentioned above has been solely responsible for the deterioration of fruit during transit. Some consider that the pre-cooling of fruit prior to shipment is the only panacea. Others, again, think that if the shipping companies attended carefully to the various matters which come under their control, such as careful handling, stowage, and proper attention to temperatures during transit, the problem of landing the fruit in uniformly good condition will be solved without pre-cooling or any alteration in our present methods of harvesting, packing, handling, and rail transportation. As a matter of fact, the problems connected with the maintenance in good order of fruit from the orchard to market are so many and intricate that it would appear a complete alteration of our present methods in harvesting, packing, and handling, and in transportation by rail and sea, is necessary to ensure, in all instances, the landing of our fruits in oversea markets in a sound and saleable condition. The series of systematic and careful investigations which have been carried out during the past decade in the United States of America and Canada (the two largest fruit-exporting countries in the world) confirm this belief. It would appear from these experiments that none of the individual disabilities which at present exist in our methods of harvesting and transportation can be held solely responsible for the loss and waste which ensues each season, but that improper methods of picking, packing, handling, and transportation all contribute in a greater or lesser degree. The scope of investigation in the United States and Canada has covered, *inter alia*, such problems as the following:—

(*a*) The effects of various methods of picking and handling fruits.

(*b*) The influence of different methods of packing, both with respect to the systems under which the fruit is packed, and, also, the style of package used.

(*c*) The results of applying cool storage at various periods after fruit is picked.

(*d*) A study of the physiological and chemical changes which take place in fruits, both under cool storage transportation and under ordinary conditions.

(*e*) The effects of punctures, bruises, and abrasions of the skin on the keeping qualities of fruits.

(*f*) The reason why fruits vary in keeping qualities, even when subjected to similar treatment regarding cultivation, harvesting, packing, and transportation.

It will be readily understood that these problems, of necessity, cover a wide field of investigation, and have claimed much time and attention. They have had the effect of altering many pre-conceived notions concerning the factors which detrimentally affect the keeping qualities of fruits. Moreover, as the investigations have advanced, the opinions formed as a result of these in their initial stages have also undergone much modification in many directions.

As the experience gained from the experiments conducted in America should be of great value to the trade in this country, more especially in connexion with the policy to be adopted in

developing the industry on proper lines, it may not be out of place to give a summary of the results obtained for the benefit of those who are possibly unacquainted with the same. Taking the investigations in their sequential order, it will be as well to commence with the picking, packing, and preliminary handling of fruits.

PICKING, PACKING, AND HANDLING.

Although it may be stated that from time immemorial it has been recognised that fruits generally, and more particularly soft fruits such as peaches, plums, and the more delicate varieties of pears, require to be handled with great care, and that this fact was as well known on the American Continent as elsewhere, yet the importance of carrying this out entirely was never recognised to its fullest extent until the investigations proved how very easily fruit could be rendered almost worthless as a result of apparently slight mechanical injuries. The experiments, after being conducted for some years, show that, from all the causes which contribute to the deterioration and decay of fruit, no less a proportion than 65 per cent. is due to mechanical injuries inflicted during the preliminary picking, packing, and handling.

It was demonstrated that the more common kinds of mould, which are responsible for the largest proportion of decay in fruits from the orchard to the market, were unable to penetrate the sound unbroken skins of the fruit. Squeezing the fruit when picking, dropping it roughly into the picking receptacle, tipping it from these receptacles on to the packing tables, conveying the fruit in springless waggons over rough ground from the orchard to packing house, the presence of dirt, gravel, or other foreign materials in the boxes, and scratches made by finger-nails of pickers and packers, were all found to be amongst the causes which contributed to the injury of the fruit. As a matter of fact, comparing the relative values of cool storage and careful handling in connexion with the keeping of fruit in a sound condition over long periods, it may be stated that the latter is of greater importance than the former. In this respect it has been discovered that the value of the application of proper cool-storage temperatures is very much lessened if due attention is not paid to careful handling and picking. It has been shown that unbruised and sound apples will remain in good condition for a longer period in an ordinary storage room than will apples in cool storage if these have been previously rendered unsound as a result of careless handling.

Although the development of moulds and other forms of decay, whose spores have found access to the fruit through abrasions of the skin, may be checked to a great extent by the prompt application of cold temperatures, yet the value of a sound skin in providing a safeguard against the entrance of decay cannot be too strongly emphasized. Even such relatively hard-fleshed and tough-skinned fruits as apples and citrus fruits should be handled with the utmost care—when being picked and packed for export they require more careful handling than eggs. Even a slight pressure of the fingers will often serve to give the fruit a bruise, which, although unnoticeable at the time, will, in the course of a few days or weeks (with greater or less rapidity,

according to the surrounding conditions), develop unsightly bruises, and eventually render the fruit unsound and unmarketable.

Concerning the particular period which elapses from the picking of the fruit to its arrival on the market at which it receives the largest proportion of injury, it appears certain that the greatest percentage of bruises takes place in the initial stages of harvesting and packing. This is so because fruit when packed properly and tightly is less liable to injury than when stacked loosely on the packing-table or in the receptacles used by the pickers.

Cool Storage, Pre-cooling, Transportation, Etc.

Although careful picking, packing, and handling have been shown to be such important factors in keeping fruits in good condition over long periods, rapid and properly applied refrigeration is also a primary essential. The development of moulds and other forms of decay proceeds with greater rapidity under high temperatures; and this development is proportionately retarded with every degree of reduction in the temperature. It is now well known that at or near the vicinity at which water freezes (31-32 degrees, F.) the development of decay is almost completely suppressed, or, at least, proceeds with great slowness. In view of this fact, it is of the utmost importance that fruit should be chilled as soon as possible after severance from the tree; and, also, because the ripening processes are accelerated after the fruit has been picked. The higher the temperatures at which fruits are picked, the more speedily should they be placed in cold storage; and in all instances fruit should be maintained at low temperatures until such time as they are placed on the market. For many years it has been the practice of the shipping companies to carry fruits at temperatures ranging from 35 to 40 degrees, F., and there can be little doubt that the keeping of fruit for so long a period as is occupied during the voyage to the United Kingdom and Europe at such improper temperatures has contributed in no small degree to the waste and deterioration which has occurred. Notwithstanding this fact, the want of rapid pre-cooling after harvesting must also bear its share of responsibility. The chief advantages which are obtained under the system of chilling fruits as soon as possible after harvesting, and keeping these chilled until their arrival on the market, are as follow:—

1. Means are furnished whereunder fruit may be allowed to mature before harvesting and shipment.
2. The development of moulds and other forms of decay (including Bitter Pit) is prevented.
3. The shipper is enabled to land his fruit in a sound and unshrivelled condition.
4. The shipping companies are assisted in maintaining the fruit at low temperatures during transit.

The advantages of being able to allow the fruit to remain on the trees until full maturity has almost been reached are so obvious that little comment is required. It may be as well to point out, however, that the superior appearance of fully-matured fruit over that of immature fruit on its arrival at the market greatly enhances its value.

Regarding No. 2, the advantages of checking the development of Bitter Pit, which, as is well known, often occurs during transit, would alone justify the establishment of the pre-cooling system. That the development of Bitter Pit in the stages in which it manifests itself after the harvesting of fruit may be retarded has been amply proved by the experiments carried out by Mr. D. McAlpine, during recent years. The result of experiments carried out at the Government Cool Stores, Melbourne, has also shown that even such rapidly developing forms of moulds as the ordinary green and blue moulds of citrus fruits (*Penicillium* spp.) are almost completely checked at the freezing point of water; and are, apparently, entirely retarded at a temperature of 29 degrees. As the freezing point of most fruits is somewhere between 28 and 29 degrees, F., the application of temperatures at which the development of these diseases are kept in abeyance may be safely applied to fruit.

(To be continued.)

ROOFING HAY STACKS WITH GALVANISED IRON.

R. R. Kerr, Dairy Supervisor.

Many tons of valuable hay are lost annually through defective roofing of hay stacks. Where the hay shed is not available, covering with corrugated galvanized iron is the most effective method, and, provided the stack is well built and the iron properly secured, no rain will penetrate.

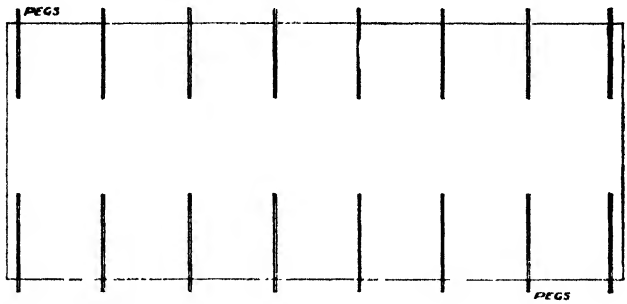
If reasonable care is taken the iron will last many years. The writer knows an instance where the same iron has been in use for twenty years, being removed and replaced every year, and still in fair order.

In building hay stacks it is much better to lay a proper foundation—one that will permit of a free current of air underneath; this will minimize the dampness that generally occurs. Having decided on the size to build the stack, place some stout pieces of wood on the outside—old posts, for instance—and fill the centre with any pieces that may be lying about, so arranging them as to allow of the air current already mentioned. With the foundation laid, secure some solid pieces—such as old rails—and place them at intervals of about 7 feet, allowing them to project 1 foot over the sides of the foundation, having one close to each end (see plan 1).

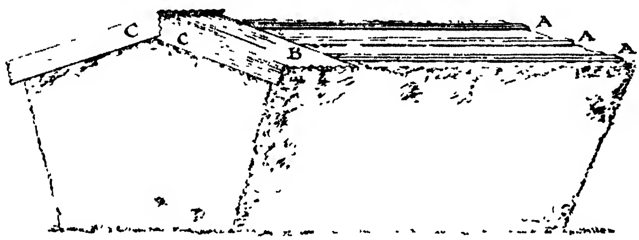
The whole secret of successful stack building is that the stack is always full in the centre and gradually increases in length and breadth as it becomes higher, the idea being that the water will at once drop off the butts of the straw, instead of trickling down the sides of the stack.

When building the roof the sheaves should be so arranged that the butts will meet in the centre.

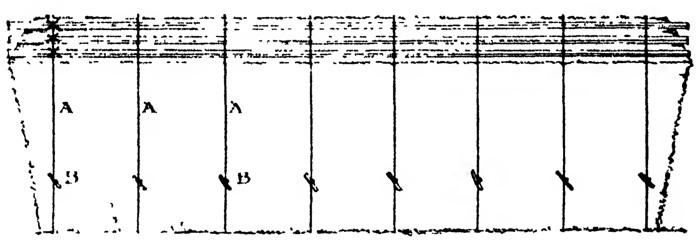
A steep roof is not necessary when covering with iron, and a fall of 2 in 12 would meet the case.



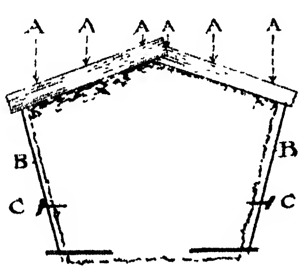
PLAN No 1
Pegs in position for attaching wires



PLAN No 2
A—4" × 2 *for nailing iron to*
B—*first sheets of iron*
C—*iron doubled over on side*



PLAN No 3
X—*wires stapled on wood*
A—*wires in position*
B—*pegs in stack where wires are tightened*



END VIEW
A—4" × 2"
B—*wire*
C—*twitch stick*

With the stack completed, procure some pieces of 4-in. x 2-in. hardwood in lengths appropriate to the length of stack—in most cases 15 feet will be found the most suitable—and lay them lengthways on the roof of the stack, allowing an overlap of about 6 inches; three rows being necessary on each side of the roof (see plan 2) one just below the ridge, one at eave, and the third midway between.

With the wood in position to suit the length of iron—a stack 21 feet wide at the bottom would require four sheets of at least 7 feet iron to reach across the roof—attach wires to the projecting pegs already mentioned in plan 1—fencing wire will do, galvanized for preference. If no provision has been made for these pegs, it will be necessary to drive some into the stack; they must be strong and at least 5 feet long. After attaching the wire to the first peg, throw across the stack and tie to the corresponding peg on the other side, and so on right along the stack; the wire should be tied fairly slack and then stapled to the wood on the roof, the staples being only partly driven in; one

wire should come in the centre of each length of hardwood, and another where the lengths overlap each other.

It is now necessary to arrange a Spanish windlass. Secure some strong round pegs about 3 ft. 6 in. long and 2½ inches in diameter; drive them into the stack, leaving about 1 foot exposed. This should be done about 5 feet from the ground and at the side of each wire. Now get other pieces a little less in diameter and about 3 feet long—1½-in. piping answers well and is everlasting—with this piece take a twitch round the wire and then a turn round the peg in the stack, then likewise on the opposite side until all are secure—if the wires are tight some difficulty will be experienced in getting the first turn on—more turns are now taken until the wires are tight, the turning stick is then secured to the main wire with a little hayband, fine wire, or held in position by another peg driven into the stack.

The wires are tightened at intervals as the stack settles down.

With the lengths on the roof in the right position and the wires tight, drive the staples well into the wood so as to avoid slipping (plan 3).

When purchasing iron, get the sheets of sufficient length to allow of overlapping about 6 inches on the ridge of the roof on the weather side, and plenty to spare to throw the water clear of the walls of the stack. Great care must be exercised in placing the first sheets of iron that the corrugation be perfectly straight all along the stack. Always start on the weather side, and after placing the first sheets double one over the end, as in plan 2. This will prevent the wind and rain beating under. These doubled sheets are secured by weights or pegs.

Two men accustomed to the work can cover a large stack in less than a day.

Always endeavour to have the stack about the same width, so that the iron will always come in right.

When opening the stack, the iron is removed in sections, one or two benches being made according to the amount of hay required; by this means little hay is open to the weather at any one time. When removing the roof care must be taken that the timbers are not allowed to stand too far out from the end, else the weight will act as a lever and cause a buckling of the remainder of the roof.

When removing the spring-head nails from the iron, procure a half-round piece of wood to fit in the corrugation beside, and so act as a fulcrum for the hammer; this will prevent denting of iron which would occur by pulling against the iron only.

All iron removed, together with all pegs, should be carefully put away for use in the following season.

SOIL MOISTURE AND WHEAT

The form and size of a mature wheat plant indicate, to a large extent, the character of the season in which it was grown—it is a kind of self-registering meteorological instrument. The difficulty is to interpret all the readings properly. At the University of Göttingen (*Inaug. Diss.*), wheat was grown under different conditions of soil moisture to see how the development of the plant was affected. In some cases the crops were kept rather dry (45 per cent. W.H.C.) during the first vegetation period, and in the second rather wet (70 per cent.); in other cases those conditions were reversed. In the results, tillering was influenced by the water supply. Tillering reduced the subsequent weight of straw and heads only under lack of moisture at later dates. In the straw the length of the upper internode was influenced by the water supply, particularly at the time of shooting, while the length of the lower internodes depended on the water content during the first vegetative period. The water supply during the first period governed the length of head and the number of kernels per head. Increased moisture at the time of shooting gave the smallest number of barren spikelets. Grain formation was favoured by an increase in the amount of water during the last vegetative period, and the weight per 1,000 kernels varied with the soil moisture on good soils. Where poor soils did not receive the necessary manures, the benefits of increased water supply were in large measure lost.

TOBACCO CURING.

Temple A. J. Smith, Chief Field Officer.

CIGAR LEAF.

In order to make the tobacco leaf grown in Victoria more attractive and saleable, greater attention is required during the curing process; this takes place from the time the tobacco is harvested until the final fermentation has been completed, just before the leaf is packed for market. Simply drying tobacco leaf is not curing it, and colour, flavour, and general quality are all affected and greatly improved under a proper system of curing. Different kinds of tobacco require different systems to develop certain qualities for various purposes, and even variation in seasons will influence more or less the methods adopted. Tobacco harvested in cold wet weather will neither cure nor ferment as well as if cut after a few genial warm days, when there is not an excess of moisture in the soil. The proper curing of tobacco is partly chemical, partly a life process, and is not simply due to the drying out of surplus moisture. Tobacco, when just harvested, contains from 70 to 80 per cent. of moisture, and if this were simply dried out by heat, the leaf would remain more or less green, and be quite unsmokeable, with bad burning qualities and no flavour, the starches and other constituents in the leaf remaining unchanged, and the tobacco would have no value. During a proper system of curing, which is partly chemical and largely due to micro-organisms in the leaf cells, the outer skins of the leaves are broken and oxidation takes place, the colour of the leaf changes from green to brown, red or yellow, according to the class of tobacco treated. These changes are caused by enzymes or ferments in the leaf cells, which during the process split up existing chemical forms through their power of taking oxygen from the air and supplying it to the contents of the plant cells, and forming new products. These enzymes are easily destroyed by too much heat or too great cold. Temperatures of over 130 degrees Fahrenheit kill them, and at less than 60 degrees Fahrenheit their operations are stopped, while at freezing point they are destroyed. The most beneficial temperature is from 80 to 100 degrees, under which they do a maximum amount of work; also a certain degree of moisture is necessary for their proper working. It is, therefore, of great importance that the conditions suitable to them should be studied closely to insure success. If the cure be too fast the work is not properly done, and if too slow the process may go too far. Quick curing is, however, more dangerous than slow curing, and unless the matter is thoroughly understood by the operator it is wiser to cure somewhat slowly, especially in the early stages of the treatment. Enzymes are easily destroyed by too much heat and too rapid loss of moisture, but if the tobacco is made to dry slowly they multiply quickly and force their way through the outer skin of the leaves, thus encouraging oxidation at a greater rate. Should they, however, be killed through scarcity of moisture, or by too much heat, they become enveloped in the insoluble protein in the leaf, and

will not then be of use during the fermentation process which takes place later on, and the result will be a poor fermentation and consequent poor quality tobacco. Leaf of fine growth and appearance, if badly cured, may be utterly useless for manufacture, while the same tobacco given a proper cure and fermentation can be made a fine manufacturing commodity with all the desired qualities for a good smoke. The various tobaccos used in factories require different treatments according to the purpose for which they are intended, as, for instance, cigar wrapper leaf for outside covers must necessarily be thin and silky, with good colour, fine veins, and a further virtue known to the trade as strength and stretch. Such leaf needs very careful treatment in both the cure and fermentation, as it will be too dry and brittle if cured fast, while if over-cured or fermented is liable to suffer in colour and elasticity. Only experience, combined with a knowledge of what the buyer requires, can determine exactly how far the treatment should go. Cover wrapper leaf is not sought after so much for its smoking qualities as for its appearance; it constitutes only a very small proportion of the cigar—about 5 per cent. of the whole—but it must have the characteristics mentioned otherwise it will not sell well. The bunch wrapper, which is the portion of the cigar immediately under the cover or outside wrapper leaf, comprising 20 per cent. of a cigar, need not be as good in appearance and so fine in texture, but should have good flavour, and burn or combustion with a nice grey ash, its mechanical purpose being to hold the filler leaf in shape before the cover wrapper is put on; such leaf must be sound and also be strong enough in texture to stand a fair amount of pressure without breaking. It must be free, as far as possible, from organic matter in the shape of starch and sugar, otherwise it will be liable when made into cigars to absorb moisture whenever the atmosphere is damp, and become soft, a bad sign in a cigar.

The filler leaf which comprises the greater bulk of the cigar (75 per cent.) must have good flavour and burn, be free from organic matter, and of fine texture, but colour is not of such great importance, though to insure high prices a dark-brown or lighter shade, which should be uniform, is desirable. Soundness, so far as holes or broken leaf is concerned, is not of great importance unless very pronounced, as the leaf is broken up by the manufacturer before being made into cigars. Flavour and freedom from organic matter, together with good combustion, are the chief points in cigar tobacco. A good aroma in all kinds of leaf is desirable, and this quality is largely developed in the cure and subsequent fermentation. Colours may vary considerably, and yet be good; a very light-coloured cigar wrapper is unusual, though the present taste leans towards the lighter shades, smokers being under the impression that a light-coloured cigar is a light smoke; this does not follow, as the filler may be any colour from light to very dark, and as 75 per cent. is filler that portion has the greatest influence. When we take into consideration the fact that the soils the tobacco is grown in produce leaf of varying descriptions, requiring a more or less fast or slow cure, also that seasons affect the condition of the tobacco, and that the various tobaccos are needed for

different purposes, it will be realized that a thorough study is necessary by the individual grower as to the special treatment required to develop to the highest possible effect the different qualities of leaf with regard to the tobacco he is producing, especially in a new country where fresh districts are being exploited. A good crop of tobacco can be absolutely ruined by bad treatment in the curing and fermentation, or by good treatment made a valuable and highly profitable crop. The foregoing remarks apply equally to pipe tobacco in the main, except that cigar leaf requires more careful handling, especially in fermentation, than pipe leaf. The proportionate amounts of wrapper, bunch wrapper, and filler leaf in each are approximately the same, and exercise the same influences in their way.

A description of the different methods in use in America and elsewhere will be dealt with, taking cigar leaf first.

In curing cigar leaf, the changes which the leaf must undergo are controlled by the regulation of heat and moisture in the shed, and until very recently fire or flue curing has not been followed, excepting in cases where continual fogs or heavy moist atmospheric conditions have existed. Curing proceeds slowly in cold dry weather, but drying takes place; while in warm moist weather the changes in the leaf constituents that are necessary take place, and tobacco cures fast. Thermometers should be kept both with wet and dry bulbs to ascertain the temperature and relative moisture in the air, both inside and outside the building. It has been found that the best temperatures at which the leaf cures in dry weather are when the inside temperature is over 70 degrees Fahrenheit, and the outside temperature is 10 or 12 degrees less; while a difference of 15 degrees Fahrenheit in wet weather is best. Tobacco will cure well at any temperature between 70 and 100 degrees Fahrenheit, but, as previously stated, it is safer to cure slightly on the slow side. While the leaf is curing fairly fast ventilation must be provided to carry off surplus moisture, especially in wet weather, or when the outside air is surcharged with moisture. The relative percentage of moisture should be between 50 and 60 degrees. In Victoria the climatic conditions are not as cold as in many tobacco countries, but the air is in some districts drier, consequently artificial methods of supplying moisture may be found advisable, such as watering an earthen floor, or covering with a few inches of straw and applying water, which as it evaporates increases the atmospheric contents. In dry cold weather the shed should be kept closed, with no current of air, or a very slight one, but the top ventilators should be sufficiently open to take off the moisture evaporating so that it will not settle from the top on the tobacco, the idea being to keep the tobacco during a cold spell from drying out, while not curing. The life will remain at such a time dormant, and directly the right degree of temperature—65 to 70 degrees Fahrenheit—obtains again curing will be recommenced. Cigar leaf during the process should not be allowed to get so dry that the leaf will break upon being handled, and should be so managed that at least once in every 24 hours it becomes soft until finished, this can be regulated by the currents of air admitted through the ventilators. It will be realized that no hard-and-fast rules can be laid down in this respect, as the treatment

will vary according to weather conditions and the stage reached by the tobacco. In the early part of the cure the moisture is driven off fast if weather conditions are suitable, but if cold and dry the shed should be kept closed to prevent its loss at too fast a rate. It may take four weeks only to cure a shed, and in some seasons twelve weeks, the latter period being more usually required unless artificial heat is applied. Only experience will tell the operator in charge when the leaf is ready for its special purpose before bulking down for fermentation. The colours should be fairly even throughout, the texture of the leaf thin, pliable, and devoid of vegetable matter, with not more than a 10 to 20 per cent. moisture content. Leaf for filler purposes and for bunch wrapper will generally require a longer and more thorough cure than cover wrapper leaf, the natural tendency to thinness and lighter body in the latter having less organic matter to be disposed of. Here, again, the operator is the sole judge as to when the cure has gone far enough for his purpose; the tendency amongst Victorian growers is, however, to cure too fast and not quite enough.

As soon as the leaf is cured the shed should be kept closed and dark; if light is freely admitted the colours are liable to suffer. Some growers favour putting the leaf down in bulk at once after curing, re-hanging later on, while many prefer leaving the tobacco hanging in the shed until ready for fermentation. Tobacco leaf can be put down in bulk in cold weather with 20 per cent. of moisture, but is liable to ferment when warm weather ensues, and should consequently be watched, and if heating it should be turned, otherwise it might go so far as to rot, and the season's labour be lost. The main matters to be carefully watched are:—

1st. To so control the air currents so as not to dry, or cure, too fast in the initial stages of treatment.

2nd. To keep, whenever possible, the inside temperature 10 to 12 degrees Fahrenheit above that of the outside shade temperature.

3rd. To close the shed when curing is finished, and, if much damp weather follows and the leaf is inclined to become mildewed, open the ventilators on a dry day, or put slow fires underneath sufficient to drive off superfluous moisture.

The curing by the aid of stoves has been recently adopted in the Connecticut Valley and Florida, in America, in regard to cigar leaf, and a useful pamphlet written by W. W. Garner, of the United States Department of Agriculture, in which the following directions for curing cigar leaf by artificial heat are given:—

"No heating system will give satisfactory results in a barn or shed which is not reasonably tight, because the temperature cannot be raised sufficiently without drying the tobacco too fast. On the other hand, a system of ventilators which can be opened or closed at will is necessary for the removal of excessive moisture in the shed in wet weather. If there is no ventilation the air soon becomes saturated, and heat alone will not drive it off. When artificial heat is used it is not desirable in filling the shed with tobacco to leave open spaces from top to bottom, as these will only act as channels for the escape of heat to the top, while to be effective it must be forced to pass through the tobacco.

The heating system must have sufficient capacity; a little heat is frequently worse than none, particularly in the control of pole sweat. Experience has shown that a satisfactory system must be capable of maintaining a temperature in the shed of from 15 to 20 degrees higher than that of the outside air when moderate ventilation is used. It is only necessary to maintain this temperature when there is danger of pole sweat; under ordinary conditions a difference of 10 to 12 degrees between inside and outside air is sufficient. The heat must be supplied from the bottom of the shed and be evenly distributed in order that, so far as possible, all the tobacco may receive the same treatment.

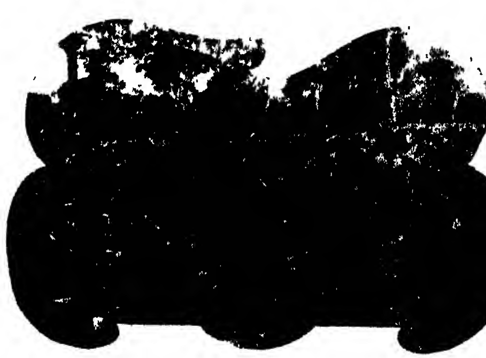
Open fires of clean burning wood and charcoal can be used, but it is necessary that special precautions are taken in case of fire, and only clean burning wood is used, as very heavy smoke from fires is apt to injure the tobacco. Charcoal is expensive, and there can be no doubt that the stove and flue curing system is best, as temperatures can be better controlled, and there is less danger of injury from excessive smoke and fire.

Coke and coal are not suitable fuels, as they generate injurious fumes, chiefly sulphur dioxide, which will damage the tobacco.

Should open fires be used, it will be found necessary to have many small fires in preference to a few larger ones, in order to distribute the heat more evenly, and appliances in the shape of deflectors in the shape of sheets of iron over the fires have good effect.

The use of artificial heat can be resorted to at any time after the tobacco has been placed in the shed, from the first day until nearing the end of the cure. Many successful tobacco-growers prefer to have the tobacco in the shed a week before using fires, especially if good natural curing weather obtains. Others say that as soon as the leaf is wilted firing should commence. Practically all the cigar types are air cured, but judicious management of artificial heat will result in a more perfect product."

The fermentation of cigar leaf and system of making flues and stoves will be dealt with, also a description of the types of sheds for curing cigar and pipe tobaccos.



ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Planting.

In preparing land for planting out—and this should be commenced right away, so as to allow the soil to sweeten—it should be subsoiled, so as to produce good results in after years. Subsoiling will add to the age and vigour of the trees; it will materially increase the crop; and it will considerably lessen the expense of fertilizers. Reference has previously been made in these notes to the success attained from growing fruit trees in subsoiled land; but the fact may be again pointed out that many growers in Victoria to-day are reaping the benefit of increased crops without artificial feeding where the soil was subsoiled before planting. Drainage is another most important factor in successful fruit culture; but while, perhaps, drainage may be delayed for a few years, if the other initial expenses are extensive, it must again be emphasized that proper subsoiling cannot be carried out after the trees are planted.

Green Manures.

The exceedingly hot dry months of January and February will have had the effect of considerably weakening the soils, and reducing the humus content. It will be advisable wherever at all possible to put in a crop of green manure to supply humus, nitrogen, and other beneficial factors to the soil. This should be done as soon as the fruit is off the trees, and the earlier the better.

An early crop is a distinct advantage. The cover crop should make good growth before winter sets in, as the plants make very little headway in the cold weather, and they require to be ploughed in as soon as the ground is dry enough in early spring. It will thus be seen that it is necessary to get a good autumn growth, as dense as possible, and one which will well cover the surface before winter.

Pests.

No codlin moth affected or diseased fruit of any kind should be left on the ground after the crop has been gathered. These should all be destroyed by boiling.

Rust-infected plum and peach leaves, as well as all foliage of stone fruits that have been attacked by this and other fungus diseases, such as shot-hole, &c., should be burned, if possible. This will minimize the possibility of future attacks. The same treatment should be given to foliage where either red spider or the bryobia mite have been in evidence.

NEW FRUITS.

The following descriptions of some of the new fruits may be useful to growers. These have been fruited at the Burnley Gardens, and have all proved very interesting varieties:—

Pear.—Marguerite Marilliat.—This is a very large and showy pear, well coloured when ripe, luscious and juicy. It will probably prove to be one of the largest of pears, being larger than either Beurre Bosc or Uvedale's St. Germain. But, being a dessert pear, this will probably be a fatal objection. It comes in about the middle of February, and, being inclined to mealiness, does not promise to be a good keeper.

Apples.—The Houblon.—This is a fairly flat apple of good size, well streaked, coloured with red, showing apparent Cox's Orange Pippin parentage. Flesh very firm, crisp, and juicy; of first class flavour, and solid fleshed right through from skin to core, with very small core. It has become a very popular apple in some parts of England.

Rival.—An apple approaching conical shape, with a beautiful bright yellow colour at base, and with rich red streakiness near the crown. The flesh is yellow coloured, well fleshed to the core; core fairly open. The flesh is crisp, and the flavour good and mellow.

Coronation.—An apple of good size, green skin, well mottled with scarlet markings; flesh very firm, greenish, well filled to the core. The flavour is very good—a good, juicy apple.

Charles Ross.—A fine coloured well streaked apple, especially on the sunny side; under skin a good yellow. The fruit is a good size, very juicy; the flesh is yellowish, crisp, and a first class flavour.

James Grieve.—A well coloured yellowish apple, skin well streaked on the sunny side. A good firm flesh, inclining to mealiness, of mild excellent flavour.

Vegetable Garden.

All vacant plots should be given a liberal surface dressing of stable manure, and then well and deeply dug. For winter growth, the beds should be elevated somewhat above the ordinary summer level. That is, the path surface may be on a lower level, the plot soil being well thrown up and boldly ridged. This will give a certain amount of drainage, and will insure warmer and better soil; the vegetables should succeed more in this class of bed than in any other.

The vegetable garden and also the seed beds should be kept free of any weeds, and a good cultivation kept up all through.

Seedlings of cabbage, cauliflower, lettuce, and celery may be transplanted out; and seeds of cabbage, cauliflower, lettuce, early peas, swede turnip, carrot, parsnip, and early onions may be sown.

Flower Garden.

One of the effects of the hot summer has been to considerably reduce the growth of some garden plants, particularly where the water

supply was not copious. This should be remedied, as far as possible, by a good autumn cultivation, mulching, and watering, if the rain does not come in sufficient quantity. The stable manure mulch should not be stinted at this season of the year, and garden plants should be given every encouragement. This especially applies to such plants and shrubs that will be blooming in autumn and winter. If these are strengthened by food and water supplies, good growths will result, which means a copious supply of blooms.

Dahlias and chrysanthemums may be fed with liquid manure, or mulched with stable or poultry manure—the latter is preferable. In any case, the feeding should not be too strong nor too frequent, and it should always be withheld before the flowers come. If the manure is supplied in the form of mulchings, it will be well to occasionally fork over the ground so that the soil does not become sour The same instructions may be taken for the autumn growing of roses.

All classes of spring flowering bulbs may now be planted. In bulb planting the bulbs should not come in contact with any manure. The manure should have been some time previously dug well in and mixed with the soil, and all heat should have disappeared. If much manure is required it should be placed below the bulb, so that the roots may ultimately penetrate to it. Bulbs thrive in sandy soils, and where the soil is heavy a little sand may be added with advantage. Bulbs should not be planted too deeply; the depth to plant is generally regulated by the size of the bulb. Such bulbs as freesias may be covered with only an inch of soil, while larger bulbs may be somewhat deeper.

All hardy annual, biennial, and perennial seeds may now be planted; among these are dianthus, candytuft, sweet peas, Iceland poppy, anemone, ranunculus, stock, wallflower, columbine, foxglove, phlox, penstemon, pansy, gallardia, &c.

Wherever aphis and red spider occur the plants should be sprayed with benzole emulsion, nicotine, "Pestend," "Soaperine," or some other preventative, in order to protect the coming flowers. Mildew attacks on the rose should also be warded off by the use of sulphur. The sulphur may either be dusted on the plant, or it may be scattered on the ground around and under the plant.

March is the month when the showy and fine summer annuals are at their best. The asters and zinnias should be very fine; and these, combined with salpiglossis, miniature annual and herbaceous sunflowers, phlox, and many other popular hardy annuals, are all now at their best. These will require a fair quantity of water and manure mulching; and the plants will be considerably helped if the blooms that have passed their prime are kept cut off.

March is one of the best months for the transplanting of evergreen plants of all classes, trees, shrubs, and palms. The roots of the transplanted plants should be disturbed as little as possible, while the roots of those transplanted from pots should be well uncoiled and set out before planting.

The soil is now warm, and the roots will quickly take hold and grow. They are thus established for the winter, and will give little or no trouble in the subsequent summer heat and dryness.

Perishable and Frozen Produce.

Description of Produce.		Exports from State (Oversea).		Deliveries from Government Cool Stores	
		Quarter ended 31.12.12.	Quarter ended 31.12.11.	Quarter ended 31.12.12.	Quarter ended 31.12.11.
Butter	lbs.	18,064,584	24,450,852	18,379,256	24,917,984
Milk (dried) ...	cases	3,508	1,996	...	...
Milk (cond.)	"	5,045	2,730	50	51
Cheese	lbs.	22,320	15,480	200	500
Bacon	"	11,520	62,500	...	...
Poultry	head	5,695	6,510	643	4,759
Eggs...	dozen	...	...	..	500
Mutton and Lamb	carcases	694,412	1,118,555	29,794	66,454
Beef	quarters	7,099	5,457	127	...
Veal	carcases	915	935	91	79
Pork...	"	...	1,491	230	858½
Rabbits and Hares ...	pairs	57,204	171,342	9,793	11,763
Sundries	lbs.	...	...	65,645	52,365

R. CROWE, *Superintendent of Exports.*

Fruit, Plants, Bulbs, Grain, &c.

Imports and Exports Inspected for Quarter ending 31st December, 1912.

Description of Produce.	Imports.		Exports.	Description of Produce.	Imports.		Exports.
	Inter-State	Oversea.	Oversea		Inter-State.	Oversea.	Oversea
Apples	9,205	–	30	Loquats .	303	—	—
Apricots... .	—	—	332	Logs ...	95	4,657	—
Bananas, bunches .	59,141	49,617	—	Maize ...	268	13,945	54
Bananas, cases ..	7,542	31,168	2	Mangoes ..	184	—	—
Barley	26,820	—	7,682	Marrows ..	165	—	
Beans	33	552	—	Melons	219	.	—
Bulbs	—	246	1	Nutmegs ..	–	396	—
Cherries	—	—	4,119	Nuts	236	2,655	—
Chillies	10	40	—	Oats	10,307	26,042	—
Cocoa beans ...	—	2,031	—	Oat Hulls	698	—	—
Cocoanuts ...	56	160	—	Onions	—	1,698	—
Coffee beans ..	—	809	—	Oranges	10,260	1,495	641
Copra	—	1,337	—	Passion Fruit ...	1,418	—	—
Cucumbers ...	7,744	–	85	Paw Paws ...	22	16	—
Dates	—	22,472	—	Peaches	—	—	310
Figs	—	553	—	Peas, dried ...	337	15	205
Fruit—				Pepper	—	249	—
Canned ...	—	—	1,392	Pineapples .	11,621	78	392
Dried ..	—	2,210	3,735	Plants	126	334	79
Mixed ...	—	49	-	Plums	—	—	480
Gooseberries ...	614	—	—	Potatoes	1,502	10,386	400
Green Ginger ...	—	108	—	Rice	4,120	8,554	—
Hay	—	115	—	Seeds	691	7,106	45
Hops	1	631	—	Spice	—	511	—
Jams, Sauces, &c...	—	—	1,051	Tomatoes ...	2,931	—	20
Lemons ...	1,627	3,130	856	Vegetables ...	2,332	342	—
Lentils	—	186	—	Wheat	4,050	1	—
Linseed ...	—	305	—	Yams	2	1	—
				Totals ...	**164,680**	**194,200**	**21,911**

Total number of packages inspected for quarter ending 31st December, 1912 = 380,791.

E. MEEKING, *Senior Fruit Inspector.*

STATISTICS.

Rainfall in Victoria.—Last Quarter, 1912.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with the corresponding monthly and quarterly averages for each Basin, deduced from all available records to date.

Basin or District.			November.		December		4th Quarter.	
	Total	Average.	Total.	Average.	Total	Average.	Total.	Average.
	points	points.	points.	points.	points	points	points.	points.
Glenelg and Wannon Rivers	178	279	212	179	239	154	629	612
Fitzroy, Eumerella, and Merri Rivers	210	287	246	184	235	166	691	637
Hopkins River and Mount Emu Creek	160	245	247	183	232	169	639	597
Mount Elephant and Lake Corangamite	158	239	275	183	220	169	653	591
Cape Otway Forest ..	294	338	309	230	280	232	883	800
Moorabool and Barwon Rivers	140	242	266	188	259	196	665	626
Werribee and Saltwater Rivers	84	237	232	188	258	223	574	648
Yarra River and Dandenong Creek	214	333	362	262	431	327	1,007	922
Koo-wee-rup Swamp ...	199	337	363	244	401	281	963	862
South Gippsland	235	376	238	257	292	329	765	962
Latrobe and Thomson Rivers	257	359	371	256	263	319	891	934
Macallister and Avon Rivers	121	227	321	184	187	269	629	680
Mitchell River	191	273	305	198	248	250	744	721
Tambo and Nicholson Rivers	181	289	279	178	330	282	790	749
Snowy River	169	346	323	204	232	282	724	832
Murray River	82	175	410	134	272	145	764	454
Mitta Mitta and Kiewa Rivers	180	322	525	251	421	247	1,126	820
Ovens River	172	324	626	228	433	235	1,231	787
Goulburn River	85	234	450	173	272	177	807	584
Campaspe River	50	200	251	160	255	176	556	536
Loddon River	38	164	197	135	234	124	469	423
Avon and Richardson Rivers	44	140	139	116	190	93	373	349
Avoca River	33	146	181	123	232	113	446	382
Eastern Wimmera	60	192	216	151	196	128	472	471
Western Wimmera	85	189	167	133	199	94	451	416
Mallee District	32	116	150	92	163	83	345	291
The whole State	114	227	277	165	246	174	637	566

100 points = 1 inch.

H. A. HUNT,

Commonwealth Meteorologist.

REMINDERS FOR APRIL.

LIVE STOCK.

Horses.—Those stabled should be fed liberally Food of a more stimulating nature can now be given to get them well over the "changing coat" season. Those doing fast or heavy work should be clipped; if not wholly, then trace high. The legs should not be clipped. Those not rugged on coming into the stable at night sweating freely should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Weaned foals should have a little crushed oats daily, if available.

Cattle.—As the nights become colder the dairy cows should be rugged. The rugs should be removed in day-time when the shade temperature reaches 60 degrees. If new grass is plentiful, give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows may now be spayed.

Pigs.—Sows not already served should be put to the boar. Supply all pigs with plenty of bedding, and see that sties are warm and well ventilated. Supply sows liberally with grain. Castrate young boars.

Sheep.—Where early lambs are being bred for local markets, transfer ewes and lambs to best pasture as soon as dropped. Castrate ram lambs when a few days old; defer tailing them until the ewe lambs are ready. After first rain (when dust is settled) clear wool from the eyes of young merino sheep; whilst yarded put weak weaners in hospital paddock, and any unprofitable woolled sheep in fattening paddock.

Poultry.—Do not feed much grain this month—soft food aids moult; add a teaspoonful of linseed to each bird's ration once daily. The more exercise the hens get the better they moult. Remove all male birds from pens. Add Douglas mixture to drinking water. Keep a sharp look-out for chicken pox. Forward pullets should now be in their winter quarters, with plenty of scratching litter, and fed liberally—including ration of animal food. Grit, shell, and charcoal should always be available.

CULTIVATION.

Farm.—Dig potatoes as they mature. Cart out and spread stable manure. Prepare and plough land for main cereal crops. Sow Chou Moellier seed in beds for transplanting. Sow the following mixture per acre for green feed during the winter months for the dairy herd:—1½ bushels, New Zealand Black Oats; ½ bushel, Cape Barley; ½ bushel, Tick Beans; ½ bushel, Vetches. Sow Giant Drumhead Cabbage for transplanting (1 lb. sufficient for 1 acre, in rows 3 feet apart); provided the soil is in good friable condition, plants from seed sown last month should be planted out. Sow wheat and oats according to locality; also rape for winter feed or green manuring. Prepare clean seed-bed for lucerne; and sow Hunter River, Arabian, Turkestan, or Peruvian seed, free from dodder, in drills 7 inches apart and at the rate of 10 lbs. of seed per acre. Sow permanent pastures with grasses and clovers.

Orchard.—Prepare land for planting; plough deeply and sub soil. Plant legumes for green manure. Plant out strawberries. Clean up Codlin Moth from trees as soon as all fruit is gathered.

Flower Garden.—Plant out evergreen shrubs, trees, and Australian plants, divisions of herbaceous plants, seedlings, layers, and rooted cuttings. Feed chrysanthemums with liquid manure weekly until flowers begin to open. Prepare land for future plantings of roses and shrubs.

Vegetable Garden.—Plant out seedlings from the seed beds. Dig all vacant spaces roughly. Sow onions for early crop; also peas and broad beans. Clean out asparagus beds wherever the seeds are ripening.

Vineyard.—Consideration must be given to manuring: early application is strongly urged. Peas, &c., for green manuring should be sown as soon as possible.

Cellars.—Cleanliness is emphatically urged. Carefully remove all fermentable refuse—skins, lees, skimmings, &c. Such odds and ends favour multiplication of vinegar flies (*Drosophila funebris*). If present, destroy these with formalin or insecticide powders A little bisulphite or sulphurous acid in washing water is recommended; also free use of lime on floors, &c.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 4. 10th April, 1913.

WHEAT AND ITS CULTIVATION.

SEED WHEAT AND ITS TREATMENT.

No. XII.

(*Continued from page* 141.)

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

An important factor in determining the yield of a wheat crop is the care bestowed on the selection and treatment of the seed.

The requirements of good seed wheat are that it should be true to name, *i.e.*, free from admixture with other wheat varieties. It should also be free from weed seeds and diseased kernels; and should possess a high percentage of germinable, healthy grains, derived from vigorous and prolific plants. Moreover, precautions should be taken with such seed to protect it, by some process of pickling, from such fungoid diseases as smut or bunt.

In the choice and treatment of seed wheat four points require consideration.

1. The careful choice of varieties suitable to the soil and climatic conditions of the farm.
2. Every effort should be made to raise the productive capacity of such varieties by systematic selection.
3. The grain chosen for seed purposes should be thoroughly graded.
4. Precautions should be taken against such diseases as bunt by the use of suitable fungicides.

Choice of Varieties.

Inasmuch as the soil and climatic conditions differ widely in the various parts of the State, considerable care is necessary to choose such varieties as are adapted to the specific conditions of the farm. Some varieties are very late in maturing, and possess protracted growing periods. These are unsuitable for dry hot districts where hot winds

in early Spring are of frequent occurrence, though they may prove of great value in districts with heavy Spring rainfall. In moist coastal areas the growing of rust resistant varieties is a matter of importance. Besides the choosing of varieties of general suitability for the local conditions, it is also necessary to bear in mind that among wheats possessing the same general characters and habits of growth, there are some, under specific soil conditions, which regularly excel others of the same class in their productive powers. The difference in the yield between two varieties of wheat grown on the same farm under precisely similar conditions is often more than sufficient to pay the interest on the value of the land on which the varieties were grown. This has been demonstrated time after time in the departmental tests and on private farms, and has been again confirmed by last season's tests at the Rutherglen Experiment Farm and the Longerenong Agricultural College.

At Longerenong, the average yield of fourteen varieties of wheat grown side by side, under precisely similar conditions last season, was 30.7 bushels—the lowest being 20.9, whilst the highest was 43.2 bushels. Again, whilst the average yield of twenty varieties at the Rutherglen Experiment Farm during the past year was 26.5 bushels, the lowest was 11.7, whilst the highest was 42.9 bushels.

The choice of the variety will also be determined by the purpose for which the crop is required, whether for green forage, ensilage, hay, or for grain. The main requirement of a variety for green forage or ensilage is that it should give a heavy tonnage of succulent material.

Tall growing, flaggy varieties, with more or less solid straw, and preferably of quick growing habit, give good results for these purposes. If such varieties are free from coarse beards, retain their colour well when cured, and possess palatable sweet straw, they make useful hay varieties. In densely populated countries, where straw is of considerable commercial value, it is essential that varieties grown for grain should give a heavy cut of straw, as well as a high yield of grain.

There is less need for grain wheats to possess such qualities in Australia since the straw is of little commercial value in remote wheat areas. For this reason short-strawed, upstanding varieties like Federation, which give high yields of grain and comparatively small yields of straw, are growing in favour.

The qualities of the varieties more commonly grown for hay, forage, and grain purposes have already been discussed.*

Change of Seed.—It is commonly held that a change of seed is necessary from time to time in order to counteract the assumed tendency of wheat from degenerating. We often hear it said that a certain variety of wheat has "run out." This is an expression of the belief that the continued growing of a given variety of wheat under unvarying soil conditions for a number of years results in the deterioration of that particular variety to such an extent as to render a change of seed absolutely necessary. In other words, it is the practical farmer's expression of the belief that varieties of wheat under ordinary conditions of cultivation tend to degenerate. Such a belief would appear to find confirmation in the fact that many of the varieties formerly

* *Journal of Agric.*, Vic., March, 1913, p. 129

grown have been displaced from general cultivation by newer varieties. On the other hand, there are many varieties which have been in general cultivation for over thirty years, and which maintain their vigour unabated. There is no reason to believe that this tendency to degenerate is a normal characteristic of wheat. Indeed, there is no reason why, with careful selection and propagation, the prolificacy of a given variety should not only be fully maintained, but even considerably increased.

Certainly, it is difficult to see how the prolificacy of any given variety can be maintained at a high level if no care is taken to preserve the very best of the crop for the next season's seed, and if careless and slipshod methods of cultivation are allowed to prevail. It is

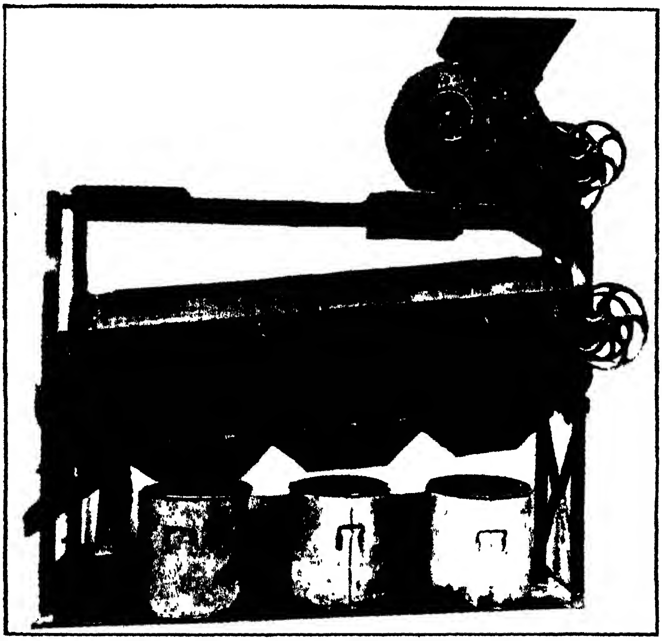


Plate I.

Maver Wheat Seed Grader

still more difficult to see how a careless grower can improve matters by securing seed from persons equally as careless as himself.

Unless the change be for the purpose of obtaining a better variety, or more vigorous seed, or for seed that has been subjected to careful and systematic selection, there can be no advantage resulting from change of seed. Indeed, if it be merely a promiscuous exchange, it is more than probable that the change would be a decided disadvantage. This would happen in all cases, for example, in which wheat is transferred from a favorable to an unfavorable environment. Again, in extreme cases, such as would happen, *e.g.*, in introducing new varieties from foreign climes, some years must elapse before the new seed becomes acclimatised.

Moreover, such change of seed is often the cause of introducing new weed pests and diseases from one district, State or country to another. The balance of evidence goes to prove that farmers should rather rely on locally developed seed, and should give more attention to their own seed, and the prevalent idea that the mere change of seed gives good results would appear to be founded more on opinion than upon well ascertained fact.

Each progressive grower must of necessity be an experimentalist—constantly observing and testing the behaviour of the varieties grown on his own farm and in his district. The poorer varieties are thus gradually eliminated, and the best varieties retained for the bulk of the farm area. Having determined the most suitable variety or varieties for the farm conditions, deliberate steps should then be taken to improve these chosen varieties by systematic selection and regular grading.

Improvement by Selection.

There is no need to dwell here on the value for systematic selection for the improvement in prolificacy in our grain crops. This subject has been already considered in some detail in the Article IX. on "Improvement of Wheat by Selection."*

To the instances there quoted illustrating the value of selection in increasing the prolificacy of a given variety may be added some results from the past year's experimental plots. At the Longerenong Agricultural College, Federation seed which had been selected for three consecutive years on the lines laid down in Article IX. was sown alongside graded seed of the same variety which had been procured locally.

Though the two plots were sown under similar conditions with 1 cwt. of super and 59 lbs. of seed per acre each, the selected seed yielded 43.2 bushels per acre, as against 34·5 bushels of ordinary seed of the same variety. It is interesting to note, moreover, that there were fifteen manurial plots sown with graded Federation seed near by, with various dressings of manure, and the highest yield was 34.7 bushels.

Grading the Seed.

The belief that shrivelled, pinched grain was as good as plump grain for seed purposes was very commonly held some years ago. Carefully conducted experimental work has demonstrated beyond doubt, however, that plump grain is greatly superior to shrivelled grain in productive power.

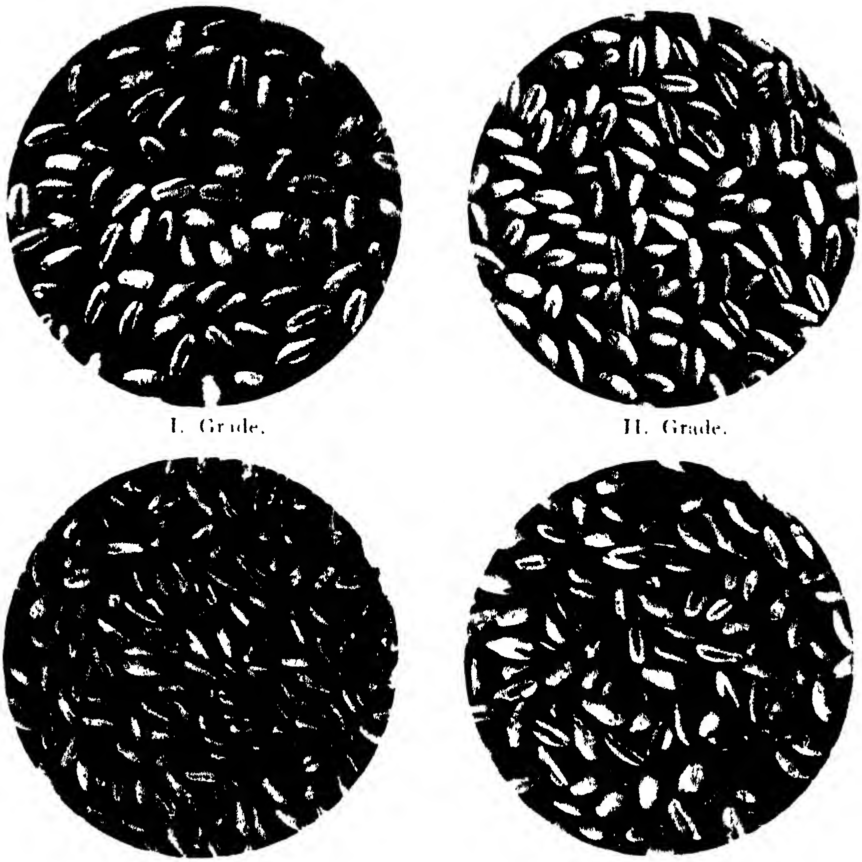
At the Ontario Agricultural College, Canada, Professor Zavitz has conducted some interesting experiments extending over six successive years with Winter wheat, and eight years with Spring wheats. Large plump grain of Winter sown wheat gave 46.9 bushels per acre, as against 39.1 bushels from shrivelled grain of the same variety, *i.e.*, 7.8 bushels per acre extra. Again, with Spring wheats, the difference amounted to 5 bushels in favour of graded grain, the large plump grain yielding 21.7 bushels, whilst the shivelled grain of the same variety gave 16.7 bushels.

An experiment was carried out at the Wyuna Experiment Farm last season to test the effect of grade of wheat on the yield. A parcel of

* Wheat Improvement, *Journal of Agriculture*, January, 1913, p. 38.

Federation seed of the previous harvest was passed through the Mayer grader shown in Plate 1. Four samples of grain resulted—Grade I., Grade II., Grade III., and screenings. The latter were rejected.

A sample of the seed just as it came from the harvester was reserved for a control plot and labelled "Normal seed." It consisted of grain of varying size, containing chaff, stems, and a small proportion of cracked and pinched grain. The grader separated the wheat into four grades Of these the first grade consisted of fine plump



I. Grade. II. Grade.

III. Grade. "Normal."

Plate II.

grain of very uniform size. Grade II. was slightly smaller in size, but very uniform and fairly plump. There were very few defective grains. Grade III. consisted for the most part of small grain, approximately half of which was somewhat pinched, and a small proportion of cracked grain. Grade IV., which consisted of white heads, chaff stems, cracked and pinched grain, was rejected.

Equal quantities of these grades, viz., Normal, Grade I., Grade II., and Grade III., were sown with the drill on 5th June, 1912, at the rate of 49 lbs. of seed and 81 lbs. of superphosphate per acre.

Plate 2 conveys an idea of the appearance of each sample. A more accurate picture of the relative sizes and weights of these various grades may be gathered from Table I., which gives the weight, volume, and density of the average kernels of each grade.

TABLE I.

AVERAGE WEIGHT, VOLUME, AND DENSITY OF GRADED SEED, WYUNA EXPERIMENT FARM, 1912.

Grade of Sample.	Weight of 100 kernels (grams).	Average weight per kernel (grams)	Volume of 100 kernels (cubic centimetres)	Average volume per kernel. (cub. cm.).	Specific Gravity of Seed
1. "Normal" Seed (from harvester)	3·117	·0311	2·338	·023	1·33
2. Grade I.	3·972	·0397	2·911	·029	1·36
3. Grade II.	2·883	·0288	2·204	·022	1·30
4. Grade III.	1·978	·0197	1·547	·015	1·27

Very little difference was observable in the growth of these plots, except that of Grade III., which appeared to be more backward than the others. The plots were harvested on 3rd and 4th January, 1913, with the following results:—

TABLE II.

YIELDS OF GRADED SEED PLOTS, WYUNA EXPERIMENT FARM, 1912.

	Amount of seed per acre	Superphosphate per acre	Date of Sowing	Date of Harvesting	Yields per acre
Grade I.	49 lbs.	81 lbs.	5th June	3rd Jan. 1913	**28 bush. 6 lbs.**
Grade II.	..	..	..	.. ..	**27 „ 53 „**
Normal Seed	..	..	..	4th Jan., 1913	**25 „ 27 „**
Grade III.	..	..	..	.. ..	**23 „ 50 „**

From the results of this experiment it is evident that grain obtained from the harvester may be divided into at least three grades of seed, of which two grades give yields considerably in excess of the normal seed, whilst the yield of the third grade is considerably below that of the Normal seed.

Grade I. gave an increased yield of 2 bushels 39 lbs. per acre over the ungraded seed, which at 3s. 4d. per bushel equals an increase of 8s. 10d. per acre. Similarly, Grade II. gave an increase of 2 bushels 26 lbs. per acre, or 8s. 1d. per acre over the ungraded seed.

On the other hand, Grade III., which consisted mostly of pinched grain, with a small proportion of cracked grain, gave a decreased yield of 1 bushel 37 lbs. per acre, that is a loss of 5s. 4d. per acre compared with the ungraded plot. Hence, for the trifling expenditure of, say, 6d. per bushel—the cost of grading the seed—less than 6d. per acre, the grain from the harvester may be separated into three distinct grades of seed, two of which give increased yields worth 8s. 10d. and 8s. 1d. per acre, and a low grade sample which would normally be reserved for the poultry and the pigs.

But there are other advantages accruing from grading of seed wheat besides the increased profit obtained per acre.

An ordinary sample of grain from the harvester always contains a proportion of cracked and broken kernels. The actual amount will vary with the skill of the harvesting operator, and with the setting of the machine.

This cracked and broken grain has little or no value for seed purposes, since it either will not germinate, or, if it does germinate, it gives rise to spindly weak plants of low productive power. This grain is, however, of value for feed purposes. Now, by the process of grading, the grain of considerable commercial value for feed, but of negligible value for seed, is separated and saved. The saving thus effected will more than cover the cost of grading, apart altogether from the higher productive value of the graded product.

If to these advantages we add that the use of a good grader will separate weed seeds, grains of other cereals, and remove rubbish, diseased and damaged grain, and steadily improve the quality and prolificacy of the seed each year, it will readily be admitted that the advantages accruing are sufficient to justify the cost of installation of a good machine on the farm. The capacity of many of the machines now on the market is such that the whole of the seed required for the seeding of a farm of average size may be graded in a few days. Under these circumstances it would seem feasible for a group of farmers to co-operate in the purchase of such a machine, and use it in rotation after harvest. As an alternative, arrangements might possibly be made by country flour mills to install a machine, and undertake the grading of seed for the farmers in the vicinity at a nominal cost

Pickling the Seed

A farmer who has taken the care to choose suitable varieties of wheat, and to improve such varieties by systematic selection and careful grading, should not run the risk of omitting to treat the seed for smut (*Tilletia tritici*). Pickling of the seed for prevention of smut is now regarded as a regular part of the farm routine.

Much effort has been spent on the production of bunt-proof wheats, and it would appear that already a considerable amount of success has been obtained Florence and Genoa, *e.g.*, have been shown in experimental trials to be practically immune from smut, whilst wheats like Medeah and Huguenot have long been known to be smut-resistant. The same cannot be said, however, for the varieties in general cultivation, for some of the most prolific yielding wheats we grow are very susceptible to smut.

The advantages of securing a bunt resistant prolific wheat must be manifest. The process of pickling would be unnecessary, and the time, labour, and expense involved in the operation would be saved to the farmer. Seeing that the quality of smut resistance has already been observed in a few varieties, it should not be difficult to impart the quality to prolific, but more smut-susceptible, varieties.

The cost of the actual pickling operations is not great, but as a considerable portion of seed is destroyed by most of the fungicides in general use, it follows that the total cost, including the damaged seed, is very considerable. The production of a bunt-proof prolific variety

is, therefore, a legitimate aim of the wheat breeder, and it is not too much to expect that such a variety will materialize in the future.

All pickling methods depend on the destruction of the spores of the fungus by suitable fungicides, or by hot water treatment. An ideal fungicide for pickling purposes would require to be (*a*) cheap, (*b*) effective, *i.e.*, capable of destroying all the spores adhering to the grain, (*c*) capable of preventing reinfection of the seed, (*d*) without effect on the germination of the grain. The fact that so much controversy has arisen regarding the various fungicides on the market is proof that the ideal fungicide has not yet been obtained.

The most common fungicides used are (1) Bluestone, (2) Formalin, (3) Fungusine, a proprietary preparation. Immersion of the seed in hot water at 132 deg. Fahr. for ten minutes has been recommended, and it is efficient, but, with the rush of work at the seed time, it proves in practice a cumbersome, slow, and unwieldly process, and is not likely to be generally adopted.

Bluestone is a very popular fungicide, and when properly used it is very effective. The stronger solutions of bluestone, not only lower the germinating capacity of the seed, but also delay its germination. The strength of the solution recommended for ordinary use is 1½ per cent., *i.e.*, 1½ lbs. of bluestone to 10 gallons of water, and the seed should be immersed in this for five minutes. Stronger solutions than this are unnecessary in ordinary farm practice, whilst a weaker solution, namely, 1 lb. bluestone to 10 gallons water, may often be used with advantage. If the seed is badly smutted, stronger solutions should be used, more particularly to avoid possible reinfection of the seed. The farmer should, however, make it his business not to sow badly smutted seed, but at all times to reserve the cleanest and best of the crop for seed purposes.

The use of a solution of definite strength is much to be preferred to the common method of using a handful or two of bluestone dissolved in a variable quantity of water to each bag of seed. It is necessary to realize that the strength or concentration of the solution is all important for successful work, and that there is an optimum concentration which gives the best results. Below this strength the fungicide is ineffectual, and with higher concentrations the germination is interfered with. From time to time various substances have been recommended to lessen the corrosive action of the bluestone, and among these, the use of lime and salt have been advocated, but the results of experimental work so far tend to show that there is no advantage gained by the use of these substances. When bluestone is used as a pickle the receptacles used must, of course, be constructed of some material other than iron. A convenient way of dissolving the bluestone is to tie the requisite quantity of bluestone, previously weighed, in a hessian bag and suspend it just beneath the surface of the water. If thrown to the bottom of the vessel it takes some considerable time to dissolve, even if the pickle is kept agitated. Two points of practical importance will be discussed later.

(*a*) Will seed pickled with bluestone and formalin retain its germinating power and vigour if not sown immediately?

(*b*) Is there any danger of reinfection if the seed is pickled with bluestone and formalin?

Formalin has been known for many years to be an effective fungicide for pickling wheat. It is a solution of formaldehyde gas in water, and the usual concentration of the commercial article is 37-38 per cent. Some years ago it was a somewhat difficult matter to secure reliable samples of formalin. There are now on the market, however, a number of brands which may be used with confidence. The strength of solution recommended for ordinary farm work is 1 lb. of formalin to 45 gallons of water, or 1 in 450. This effectively prevents smut, and does not interfere seriously with the germination. Stronger solutions than 1 in 400, *i.e.*, 1 lb. of formalin to 40 gallons water, are not to be recommended, on account of the depressing effect on the germination. On the other hand, solutions of 1 in 500, have given complete satisfaction under experimental and ordinary field conditions.

Formalin is a cheap fungicide, is readily prepared, and has not the corrosive action characteristic of bluestone.

Fungusine is a proprietary preparation which has been used as a fungicide for smut, but considerable difference of opinion exists as to its merits. Its main constituents are white arsenic and crude phenyle, and it is put on the market in the form of a bulky powder.

There seems to be little doubt that fungusine has not that deleterious effect on the germination of the seed that is observed when the seed is pickled with bluestone and formalin. Indeed, in nearly all cases in which fungusine has been used, the germination has been, for some reason or other, materially stimulated by the process of pickling.

In recent experiments it has acquitted itself well as a smut preventive, and for preventing reinfection after pickling. In using this fungicide, 2 lbs. of the mixture is mixed with 2 gallons of water, and the liquid poured over the contents of two bags of seed, and thoroughly mixed.

Methods of Pickling.

Seed wheat may be pickled with formalin or bluestone either by immersion for a stated time in a solution of given concentration, or by pouring the solution over several bags of wheat on a cement floor, and shovelling over the mass until every grain has been thoroughly wetted with the solution. Pickling by immersion is less expeditious, but on the whole it is more efficacious. The whole of the grain comes into contact with the pickle, especially if the grain is agitated within the pickle. If the grain is held in a suitable vessel, agitation dislodges any bunt balls that may be present, and causes them to float on the surface of the pickle, from which they may be skimmed off, and the danger of reinfection of the seed avoided.

There are several patent pickling machines now on the market which enable the grain to be very conveniently and expeditiously handled, and much of the old-time drudgery associated with pickling may thus be avoided.

An effective type of pickling apparatus consists of a large wooden cask to hold the bluestone or formalin solution, and a steel upright to which is attached a pulley. The seed wheat is placed in a perforated copper vessel, fitted with a false bottom, fastened by a spring. The copper vessel filled with seed is lowered into the cask by means of the pulley and kept immersed in the solution for the

specified time. It is then raised, and the solution allowed to drain through the perforations back into the cask. After draining, the copper vessel is swung round over an open bag attached on a frame to the side of the cask, the spring holding the false bottom is released and the grain drops into the bag. The false bottom is then restored and the copper vessel again charged with seed.

The barn floor method of pickling enables the work to be done very quickly, and, with good clean seed, it is a very convenient method to adopt. When fungusine is used, indeed, the barn floor method of pickling is the only one possible. The disadvantage of the method is that it is not possible to remove bunt balls that may be present, and reinfection is inevitable if the seed is at all smutty.

The question of reinfection of the seed is of some practical importance. It must be understood that while the three fungicides mentioned all have the power of destroying loose spores they are unable to destroy the vitality of the spores in the interior of any unbroken bunt balls that may be found in the seed.

These bunt balls consist, of course, of hundreds of thousands of smut spores enclosed within the firm protective shell which forms the outer integuments of the kernel. So long as these bunt balls remain unbroken, the fungicide is unable to destroy the spores in the interior of the ball, unless of course the ball be subjected to prolonged immersion in the fungicide. Hence, unless these bunt balls be removed from the seed they are a source of danger, since they are readily broken in passing through the force feed attachment of the drill, and the spores in the interior of the ball are liberated, and thus reinfect the seed. The question now arises as to whether the thin coating of the fungicide adhering to the grain is capable of preventing such reinfection.

In order to gain definite information on this point, a set of experiments was conducted last season at the Longerenong Agricultural College.

A parcel of Federation wheat was uniformly infected with bunt by breaking a sufficient number of bunt balls over the grain to make it thoroughly dark with smut spores.

A small quantity of seed was left untreated for check purposes.

The smutted seed was then divided into small lots and pickled by immersion in formalin and bluestone solutions of two fixed strengths. A small quantity was also pickled with fungusine. After pickling, each lot was divided into two portions. One-half of each lot was thoroughly reinfected by breaking an equal number of bunt balls over the seed.

The seed of the untreated, pickled, and reinfected samples was then sown, and the germination of each plot noted, as well as the percentage of bunty plants, the total yield per plot, and the total weight of grain per plot. Each plot was sown with 200 grains.

From the results of this experiment it is clear that of the three fungicides tested, namely, bluestone, fungusine, and formalin, formalin is least able to prevent reinfection of the grain. Comparing plot 12 with plot 6, and plot 13 with plot 7, it will be seen that by reinfecting the seed the percentage of bunty plants has been increased from 0.0 per cent. to 64.3 per cent. and from 2.85 per cent. to 66.05 per cent. respectively, whilst the weight of grain per plot has been lowered from 3.3 to 2.5 lbs. and from 5.5 to 3.1 lbs. respectively.

Table III. gives the results obtained at the Longerenong Agricultural College.

Table III.

Showing the extent to which Re-infection takes place with seed pickled with Fungicides of varying strengths.

Longerenong Agricultural College.

Number of Plot.	Treatment	Germination Percentage of Plants Above Ground: 1st Week. 1.7.12	2nd Week. 9.7.12.	3rd Week. 16.7.12	6th Week. 6.8.12.	9th Week. 30.8.12.	Percentage of Plants Matured	Percentage of Bunty Plants	Weight of Produce.	Total Weight of Grain.
									lbs.	lbs.
1	Clean	44·0	52·5	63·0	63·0	64·0	64	0·0	12·0	5·0
2	Smutted	47·0	55·5	64·0	63·5	60·5	56·5	51·3	11·0	4·0
3	Bluestone, 1 per cent.	39·5	57·5	68·5	74·5	75·0	68	8·8	15·0	5·0
4	Bluestone, 2 per cent.	36·5	62·5	71·5	79·5	77·0	72·5	2·06	13·0	6·5
5	Fungusine	71·5	77·5	86·5	85·5	83·0	79·5	5·66	16·0	6·5
6	Formalin, 1—300	10·0	24·0	31·5	43·0	34·5	56	0·0	8·5	3·3
7	Formalin, 1—400	33·5	33·5	47·5	63·0	58·5	52·5	2·85	14·0	5·5
8	Clean (Check Plot)	46·5	54·0	62·0	66·5	65·5	52·5	0·0	15·0	5·5
9	Bluestone, 1 per cent., *Reinfected*	56·0	73·5	75·0	85·0	82·5	75	18·6	15·0	4·5
10	Bluestone, 2 per cent., *Reinfected*	30·5	53·0	62·5	74·0	71·5	66	4·5	14·5	5·5
11	Fungusine, *Reinfected*	69·5	71·0	81·5	82·5	80·5	76·5	10·9	18·0	6·0
12	Formalin, 1/300, *Reinfected*	14·5	27·5	43·0	51·0	41·5	36·5	64·3	9·0	2·5
13	Formalin, 1/400, *Reinfected*	37·0	41·0	52·5	60·0	59·5	54·5	66·05	11·5	3·1
14	Clean (Check Plot)	58·5	65·5	72·0	81·0	81·0	69·5	0·0	15·5	5·5
15	Smutted	16·5	25·1	31·0	39·5	36·0	29·5	40·07	7·0	3·0

The other two fungicides are far better able to withstand reinfection. Thus in the case of bluestone, plot 3 treated with a 1 per cent. solution gave 8.8 per cent. of bunted plants and a total grain yield of 5 lbs. grain. The same seed when reinfected with smut spores (plot 9) gave 18.6 per cent. of bunted plants and a decreased grain yield of 4.5 lbs. per plot.

Again, a solution of 2 per cent. bluestone gave a percentage of bunted plants of 2.06 and a grain yield of 6.5 lbs., while the same seed when reinfected with smut spores had 4.5 per cent. of smutted plants and gave a total yield of only 5.5 lbs. Somewhat similar results were obtained with fungusine (plots 5 and 11). The effect of reinfection increased the percentage of smutted plants from 5.66 per cent. to 10.9 per cent., and decreased the grain yield from 6.5 to 6 lbs. per plot. Confirmatory results were obtained at Rutherglen. It will be seen, therefore, that in all cases reinfection of the seed led to an increased percentage of smutted plants and a decreased grain yield, and that these effects were by far more pronounced in the case of formalin than with bluestone or fungusine.

It follows from these results that in pickling with formalin the greatest care should be taken to see that any unbroken bunt balls are removed during the process of pickling in order to prevent possible

reinfection. Moreover, from these results it would appear that formalin is likely to be less satisfactory than either bluestone or fungusine when the sample is badly smutted, and for reasons already given, the barn floor method of pickling is more risky with formalin than with bluestone.

An interesting point in connexion with pickling is whether it is necessary to sow seed pickled with formalin or bluestone immediately after pickling, or whether any ill-effects are produced on the germination or vigour of the plants by delaying the sowing. It is contended by some that in pickling with formalin or bluestone the seed should be sown immediately. Others affirm that seed may be pickled months before seeding without any harmful effects. In order to gain some information on these points a set of experiments was carried out at the Rutherglen Experiment Farm. A parcel of seed of the 1911 harvest was thoroughly smutted, and portions of the seed were pickled with formalin, 1 in 400, and bluestone, 2 per cent., on 26th February, exactly fourteen weeks before the seed was sown. Duplicate samples were pickled with the same solution at periodical intervals up to 1st June, and on 3rd June all the pickled lots were sown simultaneously.

Table IV.

Showing the effect of delayed sowing of Pickled grain on the germination and yield of wheat.

Rutherglen Experiment Farm.

Plot	Treatment.	Date of Sowing	Percentage of Plants Above Ground — 29th June	Percentage of Plants Above Ground — 5th July.	Plants Matured.	Total Weight of Crop	Total Weight of Grain.
			%	%		lbs	lbs.
1	Untreated	3rd June	75	85	81·5	14·5	5·7
2	Smutted Seed ..	,,	30	53·5	54·0	11·0	3·6
3	Formalin, sown immediately after pickling	,,	16·5	46·5	52·5	9·1	3·5
	Formalin Sown—						
4	1 week after pickling	,,	32·5	61·5	59·0	12·0	4·5
5	2 weeks after pickling	,,	29·0	41·5	52·5	11·0	4·2
6	4 ,, ,, ,,	,,	19·0	37·5	42·0	8·0	3·05
7	6 ,, ,, ,,	,,	23·5	46·5	48·0	9·5	3·5
8	10 ,, ,, ,,	,,	25·0	38·5	41·0	7·5	3·05
9	12 ,, ,, ,,	,,	11·0	31·0	38·5	6·5	2·6
10	14 ,, ,, ,,	,,	20·0	40·0	43·5	7·0	2·65
	Bluestone Sown—						
11	Immediately ..	,,	58·5	74·5	70	10·0	4·1
12	1 week	,,	33·0	64·5	72	11·0	4·5
13	2 weeks	,,	33·5	65·0	70	10·0	4·25
14	4	,,	54·0	70·0	78·5	9·25	3·5
15	6	,,	36·0	60·0	75·5	9·25	3·6
16	10	,,	15·5	40·0	66·5	9·0	4.0
17	12 ,, ...	,,	26·0	61·0	63·5	8·9	3·8
18	14 ,, ...	,,	14·5	29	52·0	7·75	3·2
19	Untreated (Check Plot)	,,	55·0	74·5	72	13·0	5·1

While the results do not show that regularity which might be expected in a carefully conducted field trial, it would appear that the best practice to follow is to sow the grain within a week or two weeks of pickling. During this period the germination and the vigour of the plots, as expressed by yields of grain, appear to be at a maximum, and these gradually fall off as the length of time between pickling and sowing increases. This is more noticeable with formalin pickled seed than with bluestone pickled seed.

The results may be more clearly seen by dividing each of the formalin and bluestone series of plots into two sections of four plots each and comparing the yields of grain and the germination percentages. Thus the average percentage of plants reaching maturity in plots 3, 4, 5, 6, representing batches of seed sown up to four weeks before pickling, works out at 51.5 per cent., as compared with 42.75 per cent. for the remaining four plots pickled from 6-14 weeks before sowing. Moreover, the average yield of grain from the first set work out at 3.84 lbs. per plot, as against 2.95 lbs. from the last batch.

Turning now to the bluestone series, the differences between the first and second sections is not nearly so marked as with the formalin series. Thus the average percentage of plants reaching maturity with the first section (plots 11, 12, 13, 14) is 72.6 per cent., as compared with 64.4 per cent. of the second section (plots 15, 16, 17, 18). Again, the yield of the first section averages 4.08 lbs per plot, as compared with 3.65 lbs. per plot for the second section.

Finally, it may be noted that the untreated plots far outstrip all other plots both in rapidity of germination, total plants reaching maturity, and, what is far more important, in total produce and grain per plot. One needs only to look at the figures for the two check plots to see that formalin and bluestone of the strengths generally recommended, formalin 1 lb. to 40 gallons, and bluestone 2 lbs. to 10 gallons, delays the germination, lowers the percentage of plants which reach maturity, and depresses the yield per acre.

The seed for these experiments was pickled by the Vegetable Pathologist, Mr. C. C. Brittlebank, and the planting and recording of the results by Field Officers, Mr. T. M. Whelan, of the Rutherglen Experiment Farm, and I. M. Tulloh, of Longerenong Agricultural College.

(*To be continued.*)

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from Page* 178.)

PART VI.

OVERSEA FRUIT EXPORT.

By E. Meeking, Senior Fruit Inspector.

The application of low temperatures to fruits under different methods of carrying conditions, both in cool storage and during transportation, has been the subject of long and careful investigation in America. Various types of refrigerator car have been designed, and their efficiency thoroughly tested. Thermograph records of temperatures and variations inside the cars during transportation of fruit have been kept. The different results of shipping fruits under the following methods have been recorded: (*a*) In ordinary ven-

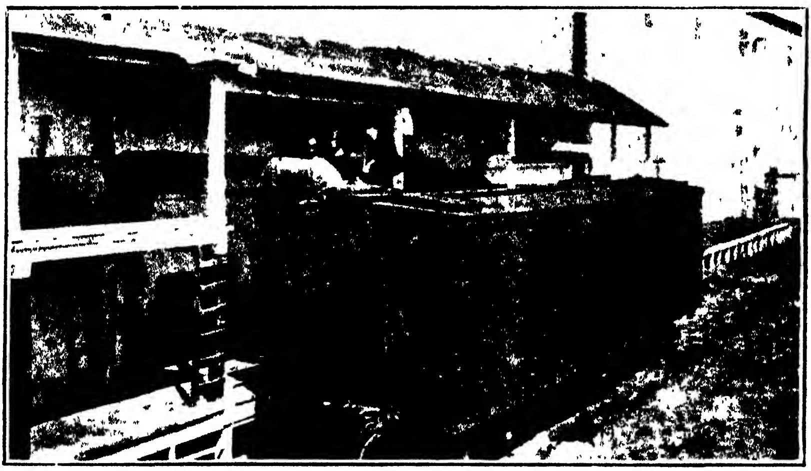


Fig. 1.—Cooling oranges in car, Los Angeles, Cal., 19

tilated cars; (*b*) under regular icing without pre-cooling; (*c*) in insulated trucks with pre-cooling of fruit; (*d*) pre-cooling and shipping under initial icing only; and (*e*) pre-cooling and shipping under regular icing.

The results of these experiments show that a minimum of variation occurs in fruit car temperatures when fruit has been pre-cooled before loading and transported under regular icing throughout the trip. Fruit pre-cooled and forwarded under initial icing only, or fruit forwarded without pre-cooling and under regular icing has been shown to vary considerably more in temperature than by the first-named method. The greatest variation occurs in cars ventilated in the ordinary way without icing during transit. The following illustrations, taken from Bulletin No. 123, 1908, Bureau of Plant Industry, Department of Agriculture, U.S.A., will serve to illustrate the variations in temperature when fruit has been forwarded under the different conditions mentioned. These experiments were conducted in connexion

with shipments of oranges from San Bernardino to Jersey City, N.Y., a trip which occupies, on an average, from eleven to fifteen days. Of course, no rail trip on this Continent occupies so great a length of time as the one under notice, if we except fruit transferred from other States to Victoria, or *vice versa*. Even in connexion with transport within the State only, however, fruit often remains in the railway trucks for three, four, or five days before shipment. The records in Fig. 6 . . . . showing fruit forwarded under ordinary ventilation, clearly indicate that even in the short space of time occupied in forwarding our fruits from the country centres to the ship's side for export, say, from three to five days, a great rise of temperature and constant hastening of ripening processes and general deterioration is likely to occur. This is especially so in hot weather. This would seem to indicate that wherever practicable it is preferable to pre-cool fruits as near as possible to the point of picking, and to forward in cars under regular icing. It is more especially, however, in con-

Fig. 2.—Cooling bananas in car Springfield, Mo., 1905

nexion with the local and Inter-State transport of our soft fruits, such as apricots, peaches, grapes, plums, &c., that the need for a proper system of refrigerator car transportation exists. The saving of the waste and loss which yearly occurs during the transportation and marketing of these fruits would more than compensate for the small extra charge which would be incurred in the matter of freight. Unfortunately, no statistics are available to show the amount of loss which occurs each season through ripening and decay of our soft fruits, and which is mainly brought about by handling, transporting, and marketing under improper conditions; but there is little room for doubt that fully 10 per cent. of these fruits are in many seasons sacrificed on this account.

Types of Cars used in Victoria and America.

In connexion with the transport of oranges from California to the Eastern States, the type of car in general use differs from the type

usually employed in Victoria for the conveyance of fruits, inasmuch as ice-cars are used with ice-bunkers placed at the ends of the truck, and hold each from 2 to 2½ tons of ice, and are usually iced at various assembling points in California after the fruit is loaded, and re-iced during transit according to requirements.

A standard car measures 40 feet in length. The freight and refrigerator charges vary according to the section of country where the fruit is shipped and the weight of fruit per car. For instance, the rate to Chicago from California on a car of 24,190 lbs. is 54 dol. 67 c., and to New York 65 dol. 61 c. The rate on a car of 27,650 lbs. (which is the weight of a standard car of 384 boxes) is 62 dol. 50 c. to Chicago, and 75 dol. to New York.

In this State, ice cars are not used under any circumstances for fruit transportation, as in the type of car used for the conveyance of

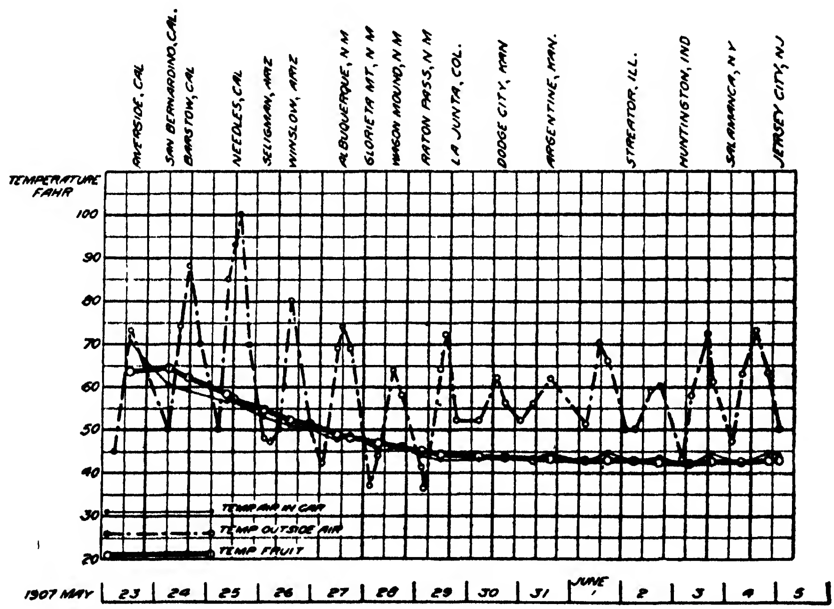


Fig 3.—Diagram showing the average temperature record of two carloads of oranges shipped under regular icing, May, 1907

perishable products generally (butter, meat, rabbits, &c.,) the ice-bunkers are placed in the top of the car, and cannot, on this account, be safely used for fruit transport. For conveying consignments which have been pre-cooled at country centres, special insulated trucks are used. These contain no ice-bunkers; but, as the cars are cooled before loading, and as the fruit itself is chilled before being loaded, it is considered that the car temperature varies very little, even during transportation over long distances.

Among the many new types of car which have ben introduced on the American Continent, and of which trials have been made, may be mentioned portable pre-cooling plants which have been fitted up to pre-cool fruit grown away from centres where no stationary pre-cooling plant can be erected, and also insulated cars with provision

made for supplying these with cold air from the stationary refrigerator plants at different points during transportation. These experiments are still in progress, and the results as to the best methods to be employed in pre-cooling and in refrigeration during transit have not yet been determined. With respect to some fruits, indeed, many ideas regarding the utility of pre-cooling have recently been much modified. This is especially the case so far as the transportation or cool storage of grapes is concerned. No system of cool storage which has yet been devised would appear to check, to any material extent, the effects of preliminary rough handling and incorrect methods of packing grapes.

PICKING, PACKING, AND HANDLING EXPERIMENTS.

In the Bulletin before-mentioned, the result of a series of experiments in connexion with the influence on the keeping quality of fruit,

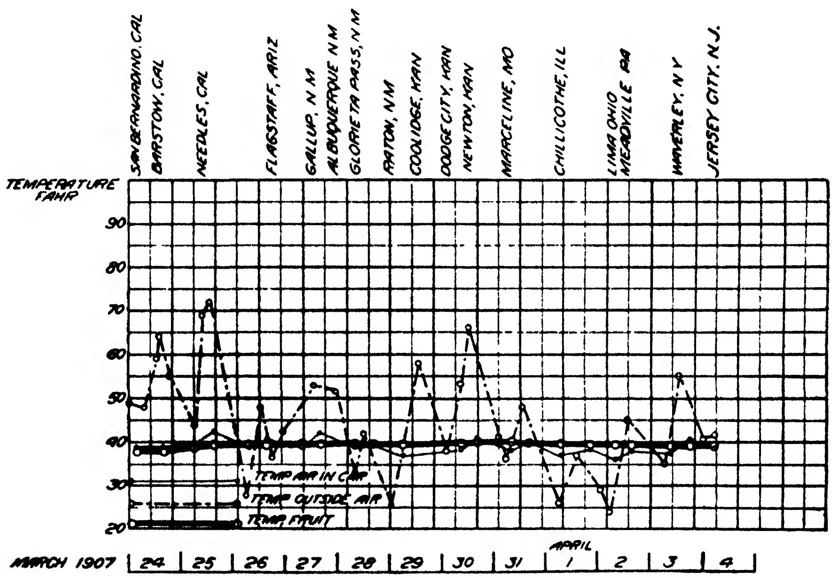


Fig. 4.—Diagram showing the temperature record of a standard carload of 384 boxes of oranges, precooled and shipped under regular icing, March and April, 1907.

of various methods of picking, packing, and handling is given The effect of picking at various periods of the year has also been carefully noted, and results published. Summed up, it may be stated that fruit, if sound when picked from the tree, will keep longest if handled so carefully as to avoid abrasions or punctures of the skin, and that fruit showing mechanical injuries develops a maximum of decay. The experiments quoted have been carried out with respect to oranges; but the results of experiments carried out with other fruits show that the same rule applies to them.

Of course, the application of up-to-date methods of pre-cooling and cool-storing fruits is necessary for successful transportation; but the grower and packer bear their share of responsibility in exercising proper and necessary care in picking and packing.. As before stated, fruit to be kept for any length of time must be free from bruises,

abrasions, or punctures to the skin. Fruit with broken skin will keep longer if cool-stored than would the same fruits if stored under

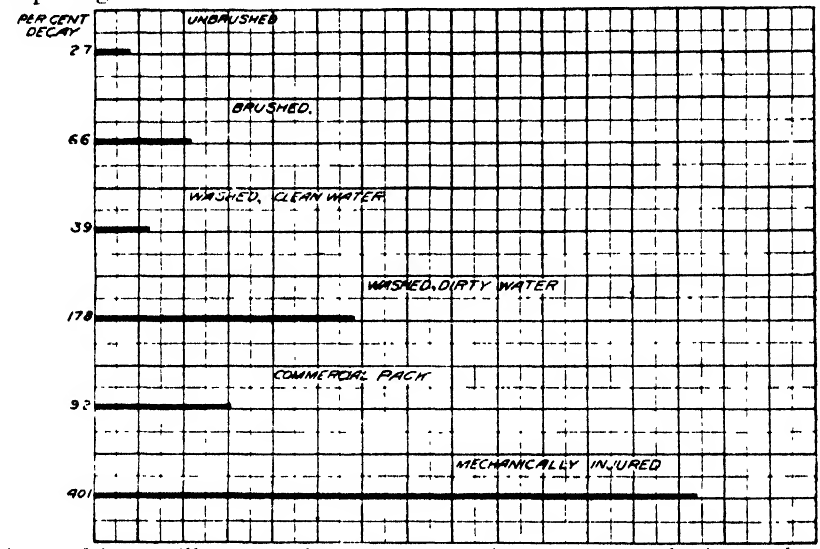


Fig. 5.—Diagram illustrating the percentage of decay in oranges held in packing houses, 1907.

ordinary conditions; but the ideal to be aimed at is to harvest fruits without mechanical injury and to apply proper cool-storage methods

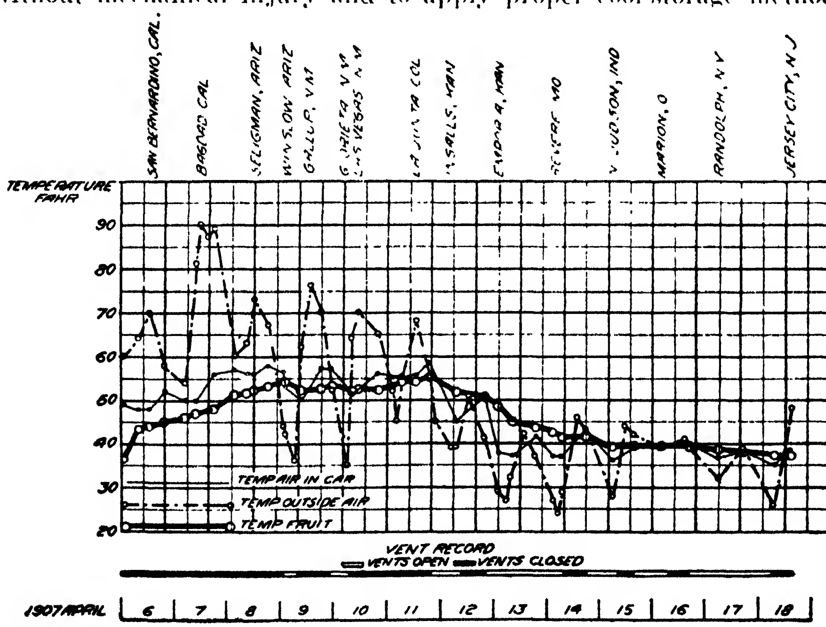


Fig. 6.—Diagram showing the temperature record of a carload of oranges, pre-cooled and shipped without icing under regulated ventilation, April, 1907.

to these as soon as possible after severance from the tree. Under such conditions fruit may be kept with a minimum of waste.

The charts reproduced herein show very forcibly the result of these experiments in America. From these it would seem that the methods in vogue in this State with regard to picking, packing, and transporting our fruits require thorough reorganization.

In the absence of reliable data, no opinion can be given with certainty; but it would appear that the blame for the loss which occurs each season during transit to the United Kingdom and Europe, and which in the past has been mostly laid at the door of the shipping companies, is due, not only to improper attention to temperatures during transit, but is largely the result of the non-application of proper methods before the fruit leaves the State.

The question, as to whether the expenditure which would be incurred in order to bring our present methods of handling fruits generally more up to date, may be judged from the results obtained during the past two seasons. These indicate that only 60 per cent. of all shipments arrive in anything like first-class condition, and that even in these latter it is probable there exists great room for improvement. It is stated that a large portion of our apples when marketed in Europe shows a more or less shrivelled appearance of the skin. This is most likely due to the non-application of cool-storage temperatures immediately after the fruit has been harvested, and also to the necessity which (through the absence of such cool storage facilities) at present exists for picking our fruits before full maturity has been attained.

(To be continued.)

SHELTER, SHADE, AND WINDBREAKS.

By J. R. Tovey, Herbarium Assistant.

Farmers, as a rule, do not go in for much tree planting, except perhaps a few shelter trees around their homesteads. Perhaps this arises from the cause that they think the land can be turned to more profitable account by employing it for stock-raising or crop-growing purposes. This may be true where the farmer has only a short lease of the ground, but when he is the owner it will pay him to plant. If you visit a farm on a windy day and see the sheep feeding restlessly to windward, or seeking the poor shelter of some gully, it would give you a very unfavorable opinion of the place, compared with that which you would form if the flock were contentedly grazing in a paddock sheltered by a belt of trees. Nothing is more distressing than to see horses and cattle listlessly moving round the fence-lines in search of a shady corner to protect themselves from the heat and glare of the scorching sun. In contrast, how refreshing it is to see them enjoying the cool shade of trees! Cattle, during very hot weather especially, prefer to feed in the cool of the morning or evening, and to lie in the shade and chew the cud during the heat of the day. Peace and contentment are as essential to the production of milk of the best quality as to putting on beef, and when the influences on milk and meat supply are duly appreciated, every paddock will have its clump of trees to shelter the

stock, both from the cold winds in winter and the heat in summer, thus combining landscape beauty with economy of grazing and farming for profit.

Some farmers think that the only benefit to be derived from tree planting is the future value of timber, and consider this too remote to be a sufficient inducement to incur the expense of planting on the farm; but this is a mistaken idea, for in a few years the benefit would begin to accrue and would become more pronounced year by year. The deeply penetrating roots, which most trees form over a part at least of their root system, draw up water from the deeper layers of the soil, to which the roots of most crops do not reach.

This water contains all the mineral constituents of the plant's food in varying proportions, and these salts are largely stored up in the leaves and bark as waste products after they have been utilized. In this way they again eventually reach the surface of the ground, while the fallen leaves and bark slowly rot and add to the percentage of humus in the soil, so increasing its capacity for holding water, and thereby aiding in maintaining the fertility of the soil.

The value of trees as humus-producers can hardly be exaggerated, for the benefits conferred upon the soil by the presence of humus in it are many and various. It increases the water-holding capacity of the soil. Thus a soil containing a fair quantity of humus may hold from two to three times as much water available for the plant's use as a pure sand.

The humus formed from the decaying leaves of trees is very valuable, the presence of humus increases the chemical action in the soil, and causes more of the insoluble constituents of the soil to be rendered soluble and available for mineral plant food. Humus lightens heavy soils and favours their aeration.

Not only do trees act as soil-makers, but also as soil-preservers. Thus belts of trees on the banks of streams do not only prevent the erosion of the banks, but their roots form a filter through which the drainage water must pass, and be partly deprived of its mineral matter. At the same time, the effect is to hold up the water on both sides, and prevent over-rapid and erosive drainage from the soil.

Settlers generally are too apt to consider bush land as something to be cleared, even to the last piece of scrub. It is not until the necessity arises of buying fuel for domestic use that they become aware of the fact that they could have profitably produced fuel for home consumption on the uncultivable portions of the farm practically free of cost.

Hedges.

It is better to have no hedges if proper attention cannot be given them. In some districts one finds hedges neglected, and allowed to run wild, taking up much valuable space and reducing the effective width of the field they occupy. A well-managed and properly formed hedge should not be more than 30 inches wide if the annual trimming and cleaning has been properly attended to, and a height of 6 feet is usually sufficient for ordinary purposes.

No doubt the expenditure incurred in fencing off a hedge from stock for the first few years prevents many farmers from improving

their properties by these desirable acquisitions, but such expense is amply repaid by ultimate results.

There is a great variety of opinion with regard to the kind of trees or shrubs that should be planted, and to the time and manner of planting. Every variety recommended might be entitled to preference in particular localities, but very few have a general adaptation to all parts of the State; it is therefore necessary to consider the condition of a given locality.

The ground where hedges are to be planted should be free from stagnant water, and should be trenched to a depth of 2 feet by about 3 feet in width. If the soil is poor or shallow in places, it should be removed and replaced by more fertile soil, so as to make the whole line as equal in quality as possible, and thereby secure uniformity in growth.

Hedge plants can be transplanted at any time from April to September. The distance between the plants depends on the size at planting, rate of growth, and variety grown.

Sea-coast Planting.

The principal evil which one has to contend with in seaside planting is caused by the saline spray, which is carried by the wind and deposited on the leaves and branches of trees and shrubs The effects of salt-laden winds are much more injurious to young trees that have been raised in a sheltered nursery than they are to those that have been exposed to the full blast from their earliest stages. This is, no doubt, the cause of many failures at the outset.

Before attempting the planting of moving sands, these must be prevented from invading and smothering the young plants, and care must be taken to keep the wind from carrying away or otherwise modifying the adjacent surface.

The preparation of the ground for seaside planting will necessarily depend on its nature. If the ground is heavy and sour, stagnant water must be got rid of by draining. On pure sand, as previously mentioned, the sand must be kept from drifting by planting sand-binding grasses—for instance, the Maram Grass (*Ammophila* (*Psamma*) *arundinacea*), Sand-Lyme Grass (*Elymus arenarius*), Hairy Spinifex (*Spinifex hirsutus*), Spreading Spinifex (*Spinifex paradoxus*), &c., and also the numerous varieties of Mesembryanthemum. These should be sown at least two years before tree planting, so as to have the whole well covered, not only to prevent the sand drifting, but to afford protection to the young trees.

The most satisfactory results can be obtained from trees raised in a temporary nursery near the planting site, if a comparatively sheltered spot, containing sandy soil, is available. The young seedlings thus early become inured to the prevailing salt-laden winds, and when planted out are less liable to their injurious effects. Young plants should be of such a size that they will not be bent by the wind, and yet large enough to prevent them being covered with sand. Suitable sizes are usually from 8 to 12 inches high. Dull moist weather should be chosen for planting, and care should be taken to prevent the drying of the roots.

SOME SUITABLE TREES AND SHRUBS.

Southern Country (Coastal, Plain, and Upland).

Australian.

Eucalyptus cladocalyx (*corynocalyx*), "Sugar Gum."
Eucalyptus botryoides, "Mahogany Gum."
Eucalyptus cornuta, "Yate."
Eucalyptus melliodora, "Yellow Box."
Leptospermum laevigatum, "Coast Tea Tree."
Acacia pycnantha, "Golden Wattle."
Acacia mollissima, "Late Black Wattle."
Pittosporum undulatum, "Sweet Pittosporum."

Exotic.

Pinus Halepensis, "Aleppo Pine."
Pinus Halepensis var. maritima, "Seaside Pine."
Pinus pinaster, "Cluster Pine."
Pinus insignis, "Monterey Pine."
Pinus canariensis, "Canary Island Pine."
Schinus molle, "Pepper Tree."
Cytisus proliferus, "Tagasaste."

Hill Country.

Australian.

Eucalyptus amygdalina, "Narrow-leaved Peppermint."
Eucalyptus polyanthemos, "Red Box."
Eucalyptus camphora, "Sallow."
Eucalyptus obliqua, "Messmate."
Acacia melanoxylon, "Blackwood."
Angophora intermedia, "Gum Myrtle."
Pittosporum undulatum, "Sweet Pittosporum."

Exotic.

Cupressus macrocarpa, "Monterey Cypress."
Cupressus torulosa, "Nepaul Cypress."
Pinus Halepensis, "Aleppo Pine."
Pinus ponderosa, "Yellow Pine."

Mallee and Dry Northern Country.

Australian.

Casuarina Luehmanni, "Buloke."
Casuarina glauca, "Grey Buloke."
Eucalyptus Behriana, "Bull Mallee."
Eucalyptus bicolor, "Black Box."
Eucalyptus cladocalyx (*corynocalyx*), "Sugar Gum."
Eucalyptus leucoxylon, "Yellow Gum."
Eucalyptus sideroxylon, "Red Ironbark."
Grevillea robusta, "Silky Oak."
Acacia elata, "Cedar Wattle."

Exotic.

Cupressus macrocarpa, "Monterey Cypress."
Pinus Halepensis, "Aleppo Pine."
Pinus insignis, "Monterey Pine."
Robinia pseudacacia, "False Acacia or Locust Tree."
Schinus molle, "Pepper Tree."
Cytisus proliferus, "Tagasaste."

The foregoing list does not by any means exhaust the number of varieties suitable for any given locality.

Additional information regarding tree planting can be gleaned from the following papers:—

"Tree Planting and Forest Preservation," *Journal of Agriculture*, April, 1907.

"Victorian Tree Planting Competition, 1912-15," *Journal of Agriculture*, November, 1911.

FARM SANITATION.

By C. H. Wright, Instructor in Plumbing, Swinburne Technical College, Hawthorn.

Part I.—Septic Tanks and Sewerage Connexions.

It has been said that a nation's first line of defence is sanitation. The statistics of this State show that a weakness exists in that line, which can be traced to country districts; but the farmer who is handy with tools can do much to strengthen that line of defence, and, at the same time, lighten the burden of domestic drudgery for his women folk. It is not recommended that the farmer should attempt to erect septic tanks and their connexions. But there is no reason why he should not understand the action of such tanks and the use of the various pipes and fittings. Such a knowledge should be of value in enabling him to better select with whom to place the work.

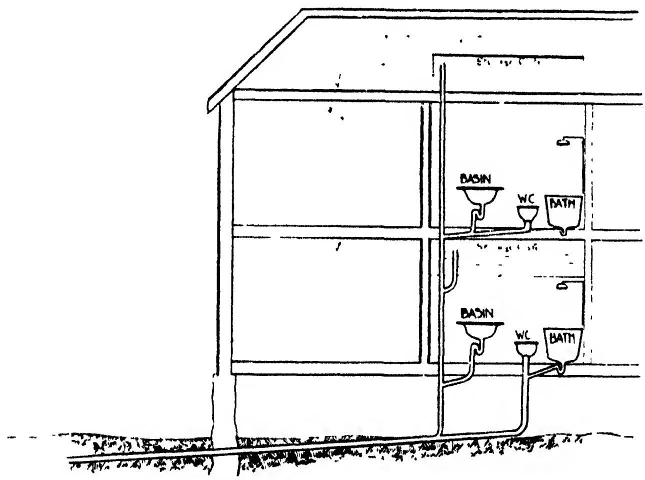


Fig. 1.—Examples of faulty construction showing how overflow pipes conveyed sewer gas into a house.

In order to better explain the risks run, and what should be avoided, the following, Figs. 1 to 5, drawn from actual cases, will illustrate that care and good judgment are necessary when septic tanks are to be installed.

Fig. 1 shows how on one farm the discharge of sewage from water closets, &c., into a river was arranged — how the storage cisterns situated in bathrooms, and also under living rooms, overflowed into pipes that joined the main sewer, and how that pipe acted as a conduit for conveying sewer gas to the cistern water, contaminating it, and also discharged sewer gas under the floors of the surrounding rooms.

Fig. 2 illustrates an instance where two water closets discharged their content into a cesspit in a garden. Waste pipes from two bathroom floors were so arranged that they acted as vent pipes, and conveyed the sewer gas directly into the bathroom, while leaking joints

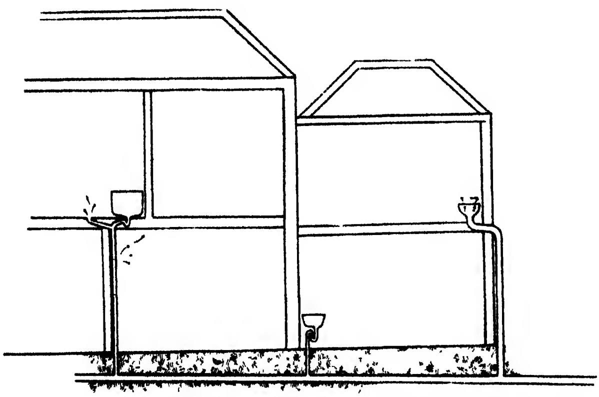


Fig. 2. Bad planning leaky joints allowed sewer gas to escape into a children's playroom causing serious outbreak of sickness.

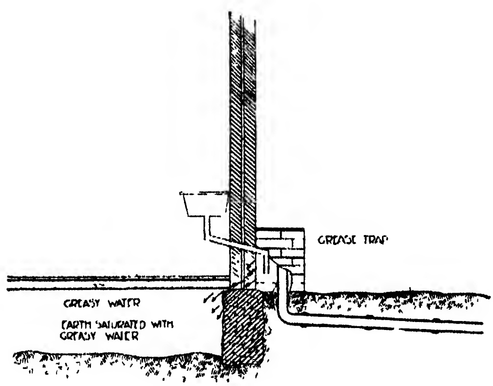


Fig. 3.—Showing how a grease trap of faulty construction resulted in the space under the scullery floor becoming very polluted.

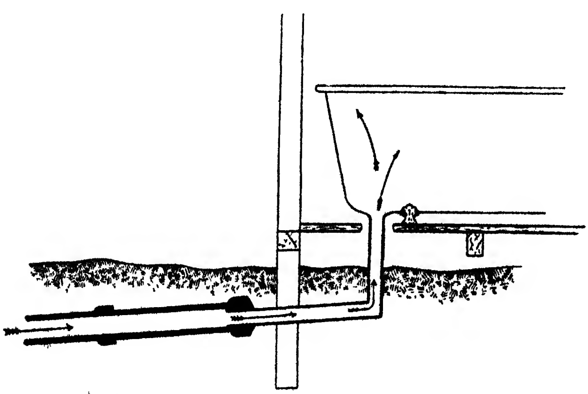


Fig. 4.—A waste pipe connected as above will convey sewer gas into the house.

in the bath waste pipes which ran up the wall of the room below, allowed sewer gas to escape into the children's nursery in such quantities that a serious outbreak of sickness occurred, and necessitated a thorough overhaul of the sanitary arrangements.

Fig. 3 shows a sink waste discharging into a brick receptacle for catching the grease. An inspection revealed the fact that the greasy water had been leaking through the joints, then through the foundations, until the space under the floor of the scullery —12 feet square— was thoroughly : aturated with greasy water; this had soaked to a depth of 2 feet in the soil below.

Many cases similar to the above could be quoted, and emphasize the value of correct planning and the employment of able workmen.

The education of the people increases the demand for sanitary fittings, and a consequent reduction in price

naturally follows. Thus bath, lavatory basins, water closets, sinks, and fittings that were at one time a luxury only to be enjoyed by the rich, are now brought within the reach of all.

Waste Pipes.

Regular water is the term applied to water more or less fouled from baths, sinks, closets and other house fittings. This is the liquid that is generally conveyed into a septic tank.

Water used in connexion with our daily life generally enters our dwellings in a pure state. It passes out fouled in various degrees. That which passes through the body acquires faecal and other solids, and, in course of sickness, germs. That used for the body acquires dirt and more or less soap. The kitchen water contains grease and vegetable matter, the laundry water dirt and soap, and all these must be conveyed away from the house as quickly as possible. The odors, too, must be prevented from entering the house: this is done by means of traps, and in modern work the bad air is discharged high up by means of vent pipes.

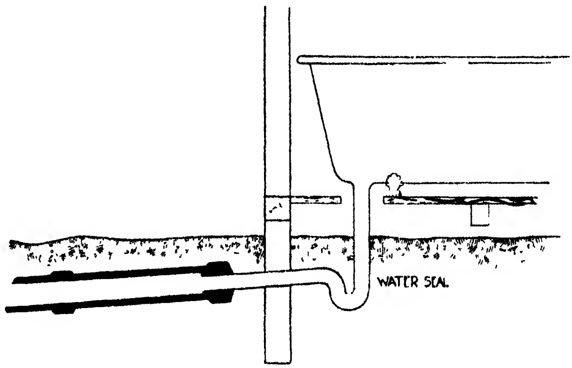


Fig. 5.—Even with a trap as above it is still insecure.

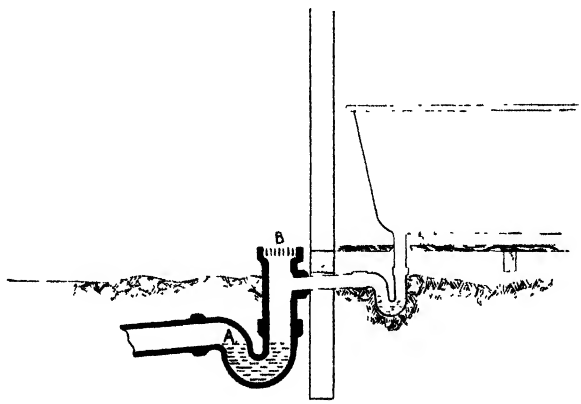


Fig 6 – Showing the correct method. The waste pipe is both trapped and disconnected.

How water from sinks, baths, &c., should enter a septic tank drain.

If the bath, basin, or sink is connected as shown in Fig. 4, the waste pipe will convey bad air into the house.

If the waste pipe has a trap containing a water seal, as shown in Fig. 5, it is still insecure, because if the trap loses its water seal, the bad air will still enter the room.

Fig. 6 is the correct way. It shows the waste pipe both trapped and disconnected from the drain.

The value of this method is clear. Supposing the trap A should lose its seal, the bad air from drain will escape readily at B.

Wrought iron pipes and brass traps should be used under floors as lead is liable to be perforated by rats and receive other damage.

Fig. 7 shows three waste pipes discharging into a gully trap; all are disconnected from the drain. The two pipes on the right-hand side are from a sink and a set of troughs. When these are together, as shown in Fig. 8, there is a great temptation to run all wastes into the one pipe. That must not be done unless the waste pipe is vented.

Have them run as shown in Fig. 8.

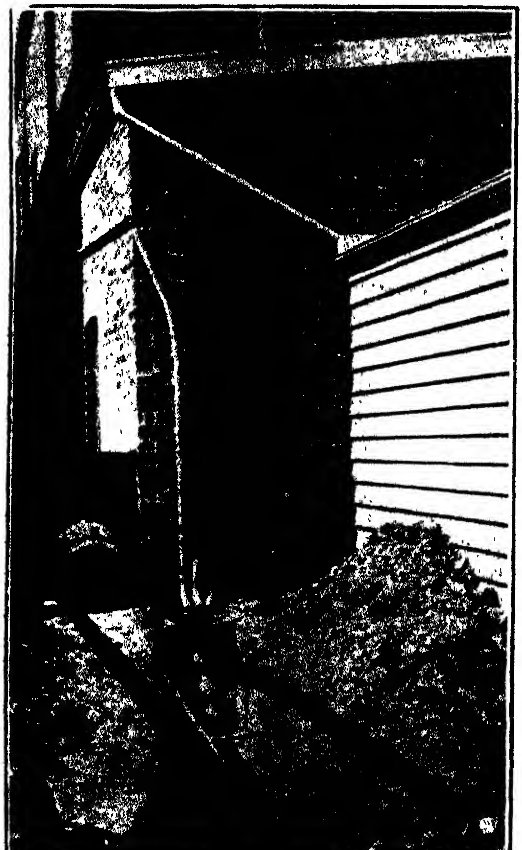


Fig. 7. Another method of disconnecting waste pipes.

When waste pipes from two or more fittings are connected to one pipe, the discharging of water from one fitting is likely to syphon out the water seal from the traps under the other fittings.

Suppose fittings were connected as shown in Fig. 9. When the water from bath A is discharged, the traps under basin B and sink C would lose their seal.

If waste pipes are arranged as in Fig 10, the traps keep their seal, and there will always be a circulation of fresh air through the pipes obtained through the foot ventilation provided by disconnecting the waste from the drain.

The sink on the ground floor is connected separately to save the trouble of venting.

Fittings.

There are various types of stoneware fittings made suitable for receiving the discharging end of waste pipes, and also providing foot ventilation. These will be referred to later.

Gratings in sinks, baths, basins, and troughs should have sufficient space area between the bars to equal, or more than equal, the sectional area of the waste pipes.

When water is discharged from the fitting, it should run through the waste pipe like a plug; it will then keep the pipe clean. But if the grating is too small, the water only partly washes the sides, consequently a gradual accumulation of offensive matter collects.

Traps should be placed as near the fitting as possible. All traps should have a water seal of 2½ inches.

There are two kinds of material used for waste pipes. Drawn lead pipe and galvanized wrought iron pipe.

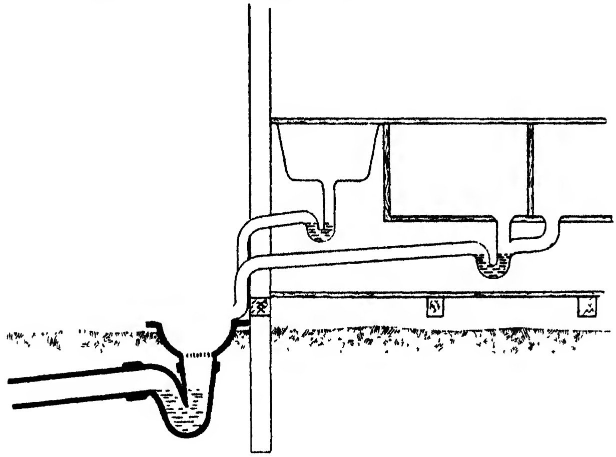


Fig. 8.—Showing how waste pipe should be run separately into the disconnecting trap.

Each have their advantages and disadvantages. Lead is smooth inside, while iron is somewhat rough. Lead is liable to sag if not suspended, while galvanized iron is self-supporting. Lead is less

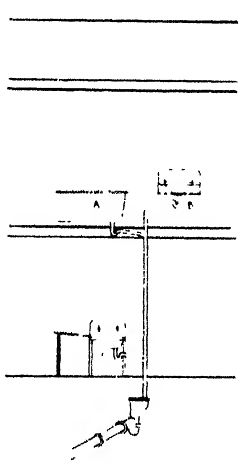


Fig. 9.—If waste pipes from inside fittings run into one pipe like this the traps will lose their seal, and sewer gas may enter the house.

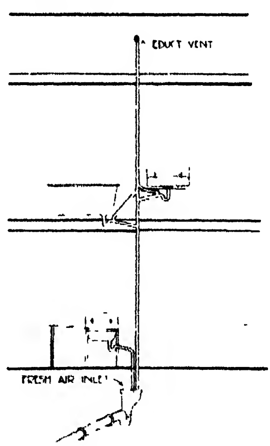


Fig. 10.—This shows the correct way vent pipes prevent syphonage of traps, and fresh air is always circulating through the waste pipes.

easily acted upon by chemicals than iron. Lead can be worked and bent to suit any position, while iron has to be cut and screwed and fittings used. However, both have their use in waste pipe work, and the advantages of both should be availed of.

Whatever material is used, sufficient cleansing screws should be provided so as to make it easy to clean a waste pipe. In lead piping, these can be inserted by the plumber making a hole in the pipe and soldering the joint.

For iron pipe work, fittings such as bends, branches, &c., can be obtained with cleansing screws included.

All branches should be curved, and right angle junctions avoided.

Fig. 11 shows how branches should be designed in iron and in lead pipes.

The size of a waste pipe must not be too small, or it will become stopped up. The sizes should be:—From a sink or wash trough, 2 inches; bath, 1½ inches or 2 inches; wash basin, 1½ inches.

The essential points in waste-pipe work are these:—

See that waste pipes are disconnected from the drain, providing a fresh air inlet.

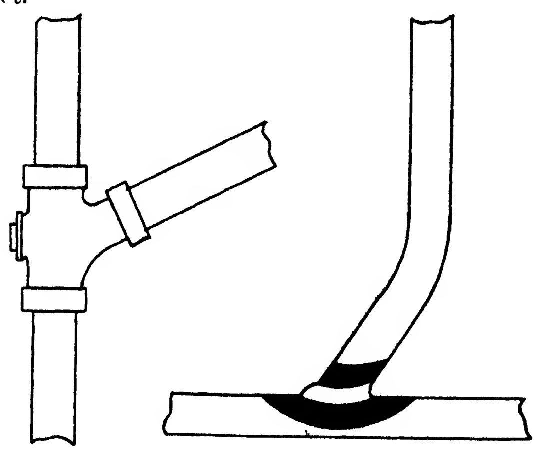


Fig. 11.—All branches in iron or lead pipes should be curved, and right angle junctions avoided.

See that all fittings are trapped; that the traps are fixed close to the fitting; that the wastes are vented so as prevent syphonage of the traps. See that sufficient cleansing screws are provided, and that all joints are free from leaks.

Occasional water, that is, water from the overflow of cisterns, bathroom floor wastes, &c., should not be connected to the drain in any way, as in Fig. 2, but should discharge direct into the open air.

The overflow of cisterns and waste from trays under fittings carried through the walls to the open air give notice when anything is wrong inside.

Baths, lavatories, sink and trough wastes should be disconnected from the drain.

Water closets and slop sinks should be directly connected with the drain.

Kitchen sinks and wastes with a heavy grease discharge should pass through a grease interceptor before reaching the drain.

(To be continued).

GENERAL NOTES.

CALF FEEDING—

Agricultural experiments vary in the value of their results. In some the value is low, owing to insufficient care being taken to eliminate possible sources of error. This often applies very particularly to feeding experiments where working with only a few animals; the superiority of the best ration may be entirely discounted by the inferior feeding or assimilative faculty of the animals receiving the feed. Some calf-rearing experiments recently conducted at Woburn for the Royal Agricultural Society of England, and reported in the *Agricultural Gazette*, illustrate the case in point. The findings may be right, but they may not—the results are inconclusive. Twenty calves were purchased in the open market when two to three days old, and were fed alike for three weeks on whole milk only. The calves were then divided into five lots of four each, and fed differently for the next nine weeks. One lot continued to receive whole milk; in the other four lots the whole milk was gradually replaced by separated milk, which was supplemented by various milk substitutes. When three months old (at the termination of the nine weeks) the calves weighed as follows:—

	Average Gain per Calf per Week lbs
1. Crushed oats	13.30
2. Whole milk	12.83
3. Cod liver oil	9.66
4. Patent calf meal .. .	8.66
5. Linseed and oatmeal gruel ..	8.29

The crushed oats were given dry, starting with a handful at a time; the other foods were mixed with the separated milk. After this weighing the calves were turned out to pasture for three months, and were treated alike, receiving also a little linseed and crushed oats with hay. At the end of this period they were again weighed to find the increase for the second three months.

	Average Gain per Head per Day. lbs
1. Crushed oat lot	2.19
2. Whole milk lot	2.00
3. Cod liver oil lot	1.90
4. Patent calf meal lot	1.75
5. Mixed gruel lot	1.57

The lots stand in the same order as when they received different feeds during nine weeks of the first period. In these circumstances it is difficult to say how far the results of the early feeding were not due to the character of the calves. A feeding experiment, to be conclusive, must use a larger number of animals. The only reliable conclusion from these tests is that dry crushed oats can be used with good results to young calves along with separated milk. That it is the best food of those tested has not been proved.

Lack of green food is apt to lower the yield and quality of milk. Silage is useful here.

AN AGRICULTURAL COLLEGE TRAIN—

In California the mountain is carried to Mahomet, and the farmers are served by a travelling college. This is a train. The season 1911-12 was the fourth year of running, and close on 5,000 miles were covered in the last campaign. In the train individual cars were devoted to special subjects of agricultural or horticultural interest, so that persons interested in a special line could visit that car in particular, listen to the lecture of the specialist in charge of the car, and ask as many questions as they saw fit. The precise number of auditors at these lectures during 1911-12 was 102,624, according to a careful census taken at each stop of the train. This was an increase of 24,000 persons, or 31 per cent. over the attendance of the previous year. Commenting on the latest tour, the *Pacific Free Press* states that there was a noted increase of interest at practically every place visited, and in all of the few instances where the attendance diminished the result was due to inclement weather. The train appears to be doing good work.

PROTEINS IN ANIMAL NUTRITION.

Carbohydrates and fat cannot for long sustain an animal in life, because it must also receive nitrogenous nutrients. The chief nitrogenous nutrients in any fodder or ration are the proteins (albuminoids). Proteins however are of different kinds, and the proteins of one plant and in a minor degree of one part of a plant, differ from the proteins found in other plants or in animals. During the last half-century it has been customary to assume that the need for nitrogenous nutrients by the animal could be made good by any protein, regardless of its origin, provided only that it was capable of digestion. Recent investigations controvert this view. It now appears that the various proteins have a specific value in nutrition, this value in each case depending upon the kind of cleavage bodies, or animo-acids, into which it is broken up on hydrolysis. In the *Zeitsch. Physiol. Chem.* 77 (1912) it is stated that an animal can be sustained exclusively on the cleavage products of suitable proteins, and that a protein which contains animo acids in a proportion unlike that found in the body tissues, is not so well utilized as one which yields them in the quantities in which they are found in cell protein. As would be expected from this, most plant proteins are less well utilized than those of animal origin, and to get to the root of the matter it is necessary for the chemist to know something of the animo acids contained in the proteins of different feeding stuffs. For the farmer it is generally beneficial to use mixed grains or fodders, because the proteins of the several ingredients yield bodies which are complementary to each other in the animal economy.

With foods the mere fact of change generally stimulates milk-production, but unless the change is to a really better class of food the improvement will be short-lived.

BUNYIP MILKING COMPETITIONS.

By P. J. Carroll.

The following are the particulars of tests carried out at the Government Cool Stores of cows entered for competition at the Bunyip Agricultural Society's recent Show. The results represent 24 hours' production, and may be taken as representative yields of the cows competing:—

Test No.	Lbs. Milk	% Fat.	Butter Fat	Total Fat
1 N	15½	4·8	·744	1·569 lbs.
1 M	16½	5·0	·825	
2 N .. .	17½	5·8	1·015	1·840 ..
2 M	16½	5·0	825	
3 N	17½	4·2	·735	1·279 ,,
3 M .. .	17	3·2	·544	
4 N .. .	16	5·2	832	1·504 ..
4 M	16	4·2	·672	
5 N	19¼	3·8	·731	1·352 ..
5 M ..	18¼	3 4	621	
6 N	23½	5·7	1·347	2 257 ..
6 M .. .	26	3·5	919	
8 N ..	20	4·4	·880	1·285 ..
8 M .. .	11¼	3·6	405	
9 N ..	20	4·0	·800	1·590 ..
9 M	25½	3·1	·790	
10 N	15½	5·6	·868	1 811 ..
10 M . ..	20½	4·6	·943	
11 N .. .	28¼	4·3	1·215	2·167 ..
11 M	25¾	3·7	·952	
12 N	19½	4·0	780	1·502 ,,
12 M	19	3·8	·722	

From the above table the following deductions may prove of interest to dairymen:—The average yield of fat of the 11 competing cows was 1.65 lbs. per day, equal to 11.55 lbs. per week; or for an average month 50.325, worth at 1s. per lb. £2 10s. 3d. per cow per month. This is a very good average result; yet there is nothing to prevent the farmer attaining such a standard with his dairy herd. At the present time it is safe to say that it is not reached by many dairy herds in the State. Good as the average is, an analysis of the figures will show the possibility of still further improvement.

The best cow (No. 6) produced 2.257 lbs. of fat in 24 hours, equivalent to 15.8 lbs. per week, or 68.83 lbs. of fat per month, worth at 1s. per lb. £3 8s. 9d.

The three best cows (Nos. 6, 11, 2) yielded an average of 6.264 lbs. of fat per day, 43.848 per week, or equivalent to 191 lbs. of fat for the month, worth £9 11s.; or an average of £3 3s. 8d. per cow.

The production of the three worst cows (Nos. 5, 8, and 3) was 3.91 lbs. of fat per day, 27.41 per week, or 119.43 lbs. for the month, valued at £5 19s. 6d.; or an average of £1 19s. 10d. per cow.

The worst cow (No. 3) produced 1.279 lbs. of fat in a day, 8.953 in a week, or 39 in the month, worth at the same value as the others £1 19s.

Assuming that a dairyman had a herd of 20 cows equal to the best cow, his gross return for cream for the month would amount to £68 15s. sterling; if in accordance with the three best cows, the value of the month's production would be £63 13s. 4d. The average for a similar herd of the three worst cows would be £39 16s. 8d.; or, if the worst cow be taken, the farmer would receive from his herd £39 sterling, or £24 less than the estimated return from the best cows.

The striking feature of these comparisons is that the farmer who was fortunate enough to have a herd similar to the best cow would receive £29 15s. larger return for the month than the owner of the herd of a character in accordance with the lowest on the scale, or, to put it in another way, assuming the same amount of labour, the same quantity of food, and possibly the same amount of capital would be required to produce the return from either herd, although the receipts from one would be 75 per cent. more than from the other.

To still further extend the comparison, it would take nearly 22 of the three best cows to equal a herd of 20 like the best cow, 34 of the three worst, and 35 like the worst cow, to equal 20 of the best cows.

As a matter of fact, the average from the worst cow is not by any means a poor return, and many dairymen would be glad to have a herd giving such a return; but the comparison tends to show the enormous room there is for improvement, and demonstrates the great economic advantages that would accrue to dairymen by systematically culling, and breeding only with bulls of noted butter-producing strains.

The mere fact of breeding and culling, however, is not sufficient. Feeding is essential for the economical production of butter fat, and there is, indeed, ample room for improvement in this direction: and efforts to improve the production of our herds in the manner indicated must be preceded by, or carried on simultaneously with, greater attention to the production of fodder.

ESTIMATING HAY YIELDS—

It is a custom with some farmers when cutting hay to keep account of the balls of twine used. By this means they check their estimate of the probable yield. At the Roseworthy College this method of judging yields has been tested by weighing each load of hay as it went to the stack, and the results are given in the South Australian *Journal of Agriculture.* In 1911 the yields worked out at 2 tons 6½ cwt. per ball of binder twine. In 1912 the tests were repeated separately on half-a-dozen good-sized paddocks, and the figures ranged from 1 ton 15¼ cwt. up to 2 tons 9¾ cwt., according to the height of the straw and the freedom from under-growth. The reasons for these variations will be readily understood. For the season, the general average at Roseworthy worked out at 2 tons 0½ cwt. on 237 acres of crop. It is noted that many farmers calculate on 2 tons as a fair average figure, taking one season with another; but that where the hay is tall and well-grown, and tolerably free from weeds and under-growth, an estimate of 2½ tons per ball of twine will come nearer to the truth.

THE USE OF PHOSPHATES IN VICTORIAN AGRICULTURE.*

(*Continued from page 165.*)

By John W. Paterson, B.Sc., Ph.D., Experimentalist, and P. R. Scott Chemist for Agriculture.

Attention has been drawn to the low percentage of phosphoric acid in Victorian soils as extracted by strong mineral acids. As in cropping, the total acid is of importance only in so far as it is capable of yielding available phosphoric acid, the particular form of combination in the soil ought at first sight to determine its immediate value. The principal soil phosphates are those of calcium, aluminium, and iron. As tri-calcium (lime) phosphate dissolves—if somewhat slowly—in dilute acids, while the phosphates of iron and aluminium are practically insoluble, Dyer's solvent (1 per cent. citric acid) should throw some light upon the form of combination in which the phosphoric acid exists in soils.

A considerable number of soil analyses have been made in the laboratory of the Department of Agriculture by Dyer's method, and the following table shows the results for three groups. Dyer estimates that less than ten parts of phosphoric acid extracted by 1 per cent. citric acid shows the soil to stand in immediate need of phosphatic manuring:—

Available and Total Phosphoric Acid per 100,000 Dry Soil.

District.	Available Phosphoric Acid.	Total Phosphoric Acid.	Percentage of available in Total.
Wimmera (14 soils)	7·8	52	15
Mallee (6 soils)	4·5	50	9
Goulburn Valley (4 soils)	3·6	68	5·3
Hall's English soils (10 soils)	19·17	98	19·6

Of the Victorian soils here mentioned, the Goulburn Valley group alone are deficient in carbonate of lime, and here the percentage of availability is lowest. We do not, however, attempt to trace a definite connexion here with the lime factor; suffice it to point out that, in the soils examined, the available phosphoric acid is decidedly below the 10 parts minimum set by Dyer, and that not only is the total phosphoric acid, as previously pointed out, low, but this phosphoric acid has a lower percentage of availability than is found in English types.

It will be agreed that the availability test for phosphoric acid has certain uses, but that it is also at times a quite unreliable guide as to the practical needs of a soil. Personally, we can only regard it as giving general indications. As a guide it often breaks away. Examples may be quoted at random. Thus, in some of the Departmental oat experiments, one soil showing only 3.4 parts available phosphoric acid gave no increase with 1 cwt. super.; one with 15 parts gave 1,836 lbs. increase with 2 cwt.; and one with 20 parts "available" phosphoric acid gave 2,307 lbs. increase with 3 cwt.

* Address delivered at the Melbourne meeting (1913) of the Australasian Association for the Advancement of Science.

super. Similarly, in America, Wheeler* found that from three different soils $\frac{N}{5}$ nitric acid extracted 14, 16, and 14 parts of phosphoric acid, but the corresponding turnip yields were 22, 8, and 2 tons. Hydrochloric acid of the same strength gave similar results. Equally unsatisfactory results were obtained with $\frac{N}{100}$ ammonium hydroxide.

The discrepancies which invariably occur when one endeavours to connect a number of analyses of available phosphoric acid with the cropping efficiency of the same soils seem to indicate that the method of phosphoric acid absorption by plants is very imperfectly understood. It is no simple case of solution by acids and osmosis through the plant root. Were it so the availability test would be theoretically perfect. Soil acidity seems to help the solution of insoluble phosphates in one way, and hamper it in another. The effect depends, apparently, upon which particular phosphate predominates—whether lime phosphate, or iron and alumina phosphates within the soil.

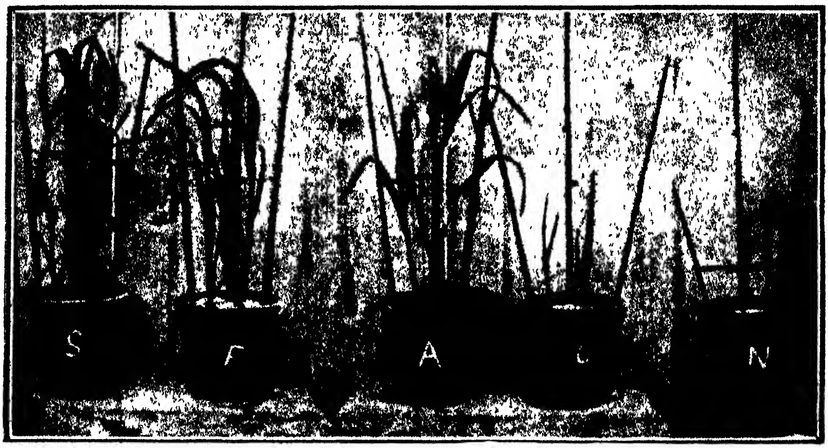


FIG. 3.—RESULTS OF POT EXPERIMENTS AT ROTHAMSTED.

S denotes superphosphate and N no phosphate

A great deal of work has been done in different countries upon the action of different phosphates upon crops. A simple experiment recently conducted at Rothamsted† seems to carry a deeper meaning than has been read from it. Oats, peas, and swedes were grown in pots containing chiefly pure white sand extracted, with concentrated hydrochloric washed, dried, and ignited. Three per cent. of pure carbonate of lime and .5 per cent. of ferric hydrate were added, and a nutrient solution containing all the essentials except phosphoric acid was used. To one series of pots there was added freshly-prepared aluminium phosphate; a second series got ferric phosphate; and a third got tri-calcium phosphate prepared by precipitating tri-sodium phosphate with calcium chloride. The results were as follows:—On the aluminium phosphate, oats did well throughout, and were a good colour; peas did well, but pods not very numerous, and late; and swedes did well from the start. Ferric phosphate gave very similar results to the aluminium salt with each crop. The calcium phosphate

* *Eighteenth Ann. Rep. Rhode Island Agric. Exp. Sta.* † *Jour. Ag. Sci.*, Jan., 1912.

however, failed with oats, and was no better than the no-phosphate series set up for control; peas were poorly developed, made few pods, and ripened early; swedes were late in starting, but did well ultimately. In another set of experiments, leaving out aluminium phosphate, and where the crops were weighed, calcium phosphate was about equal to ferric phosphate with peas and swedes, but markedly poorer with the oat crop.

Two deductions are made from the results. One is that the availability of a particular phosphate is dependent upon the kind of crop. This is obviously true. The other is that insoluble calcium phosphate is markedly less effective in the growth of oats than is insoluble iron phosphate. This statement is too general. Had the soil received a minimum amount of carbonate of lime, the results would almost surely have gone the other way.

The superiority of iron and aluminium phosphates in these limed soils to freshly precipitated calcium phosphate renders it improbable that the solution of any of the phosphates was accomplished by the physical action of acid solvents. There appears to be some virtue in phosphoric acid which is able to change into new combinations at the plant roots, as would be the case of the iron and aluminium phosphates in these experiments, but not of the lime phosphate. Doubtless the formation of insoluble ferric or aluminium hydrate would be a chemical motive for the change from iron to lime phosphate in a weakly acid medium, but it is difficult to see why this change, if it occurred here, should give an advantage to the new lime phosphate formed from the iron salt over the ready formed lime phosphate given as manure, unless the change were helped either by a physiological action of the root hairs or by bacteria living in symbiosis with the plant. If, as seems likely from the results, the mere fact of changing bases helps the assimilation of phosphoric acid, the inference is that either the plant itself or something helping the plant is at work in bringing the change about.

In an acid soil the orthodox view of solution of phosphate and osmosis by the root hairs can explain the results, but in a soil which is liberally supplied with lime carbonate, as in the Rothamsted experiments, a physiological rather than a physical explanation of absorption appears necessary. The same is true with regard to the not inconsiderable quantity of phosphoric acid always present in the humic matters of ordinary soils.

The fact that certain phosphates are better absorbed by some crops than by others sugests a physiological explanation of solution in cases where the soil is neutral or alkaline. No differences in the relative acidity developed at living roots are sufficient to show why one crop should starve while another does well on the same phosphate. As Wheeler states,* "the great difference in the ability of individual plants to utilize the several phosphates under varying conditions is not properly appreciated." On acid soils, or with plants grown in water cultures, the physiological assimilation of phosphoric acid may lapse in favour of the purely physical process. It is for this reason that in agricultural experiments one phosphate is best on one soil

* *Jour. Ind. & Engin. Chem.*, Ap., 1910.

and another on another. Generally speaking, there is no "best" phosphate, because the effect will always depend upon the conditions of the soil as well as on the crop grown.

In the districts of this State which are poorly supplied with lime it may be assumed that the greater portion of the phosphoric acid is in union with iron and alumina. The Chemical Department of the Wisconsin Station, in America, submitted twelve soils to extraction with dilute acid and alkali respectively, and from preliminary tests on native minerals they calculated the ratio of phosphoric acid in union with iron or alumina to phosphoric acid in union with lime.* Six of the soils were acid, and six were well supplied with carbonate of lime. In the results obtained in this way it was found that in the acid soils the ratio of iron and aluminium phosphates to lime phosphate was as 3 to 1; in the non-acid soils it was nearly 1½ to 1. The low percentage of availability of the phosphoric acid in Victorian soils when extracted with citric acid has been referred to. In such cases a high ratio of insoluble iron to lime phosphate may be depended on.

Where soils are deficient in lime, therefore, an application of this substance may be depended on to increase the availability of the phosphoric acid. The effect of lime upon insoluble iron and aluminium phosphates added as manure at Rothamsted has been referred to. Where phosphatic manure of any kind lies in the soil for some years it will largely revert to the iron and aluminium combinations. If land is limed, apparently the crop can largely recover this by absorption when it is wanted. Wheeler† gives the results of liming upon various crops at Rhode Island on plots which had each received 82 lbs. of phosphoric acid in various manures per acre up till 1902, and then no further application of phosphates. Nitrogen and potash have subsequently been given each year. Lime was applied in 1903 at the rate of 1 ton slaked lime per acre. In 1909, seven years after the phosphate applications ceased, the following yields of potatoes were obtained from the different manures:—

RESIDUAL EFFECT OF PHOSPHATES ON POTATOES.

Seventh Crop.	Dissolved Bone Black.	Dissolved Bone.	Super.	Steamed Bone.	Thomas Phosphate.	Ground Rock Phosphate.	Raw Iron and Al. Phosphate.	Roasted Iron and Al. Phosphate.	No Phosphate.	Double Super.
With lime (1903) ..	680	676	554	630	592	505	347	594	405	607
Without lime ..	450	529	519	556	580	510	244	224	145	333
Increase due to lime	230	147	35	74	12	- 5	103	370	260	274

Liming produced its maximum effect with the roasted iron and aluminium phosphates and the no-manure plot, where presumably the native phosphates were chiefly of iron and aluminium. It had also a good effect with the raw iron phosphate, but with the ground rock (lime) phosphate and Thomas phosphate it had no effect. Viewing the results generally, it is seen that, without lime, calcium phosphates

* *Research Bulletin No. 2.* † *Loc. cit.*

were much the best, but with lime added the more refractory phosphates and also the no-manure plot made up much of their leeway.

The effect of lime in liberating insoluble soil phosphates is well seen in some experiments which we conducted last season at Burnley. The soil was obtained from Richmond Park, and was a dark volcanic loam. It was mixed with half its weight of fresh-water sand. The experiments were conducted in pots, in order to compare the manurial effect of certain materials with their unit values. Wheat was grown, and each pot, holding 45 lbs. soil, received .15 gram phosphoric acid along with .5 gram of nitrogen (dried blood) and .5 gram potash (as sulphate). The results are the average of duplicates, which agreed with tolerable accuracy:—

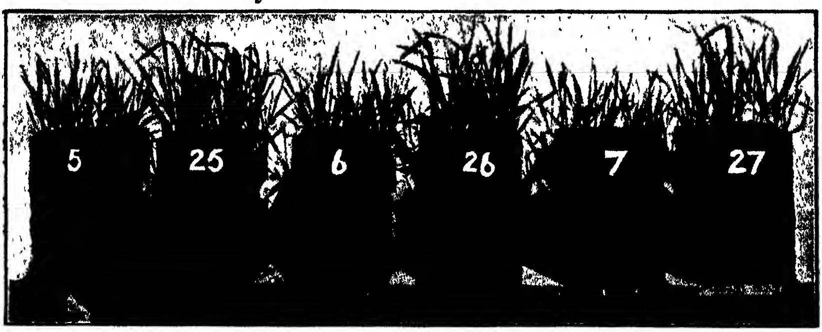


FIG. 4.—BURNLEY EXPERIMENTS.—SHOWING HOW LIME SPECIALLY HELPS THE PHOSPHATES OF IRON AND ALUMINA.—THE YOUNG CROPS.

EFFECT OF LIME ON INSOLUBLE PHOSPHATES.

Phosphate added as—	Without Lime.	With Lime.
	grams.	grams.
No phosphate	56·16	73·37
Total in superphosphate	72·89	73·66
Water insoluble in super.	62·27	68·53
Citrate insoluble in super.	58·05	73·23
Bone meal (coarse)	59·25	72·00
Bone meal (fine)	65·88	72·25

It is apparent that while without lime each phosphate gave an increase, still the addition of lime seemed to act upon all the pots, including the no-manure pots, so that the differences were levelled up. That occurred for this particular soil after sifting and carefully mixing with the lime. It is not to be expected—and, indeed, the idea must be guarded against—that on average soils with lime applied broadcast on the surface the lime could replace phosphates in practice. The results, however, show the tendency of lime to liberate phosphoric acid from insoluble soil phosphates, and harmonize in direction with Wheeler's field experiments at Rhode Island.

Other experiments which we conducted at Burnley show that lime has a special effect upon iron and aluminium phosphates, and little or no effect upon calcium (lime) phosphate. A native (South Australian) calcium phosphate was tested against aluminium phosphate (wavellite) and iron phosphate (vivianite). The accompanying photographs show that, without lime added, calcium phosphate (pot 5) gave a better yield than either the aluminium phosphate (pot 6) or

the iron phosphate (pot 7). When lime was used along with these phosphates, however, the aluminium phosphate (pot 26) was superior to the calcium phosphate (pot 25), and the iron phosphate (pot 27) was also greatly improved in its action by adding lime. The differences, as the earlier photograph shows, were strongly apparent in the young plants, showing that phosphoric acid is specially required by plants in the first stages of development.

In an earlier part of this paper it was noticed that dissolved phosphate was the principal source of supply to the Victorian farmer. Generally speaking, and looking to the low humus content of our soils, it is likely to remain his best source for many years to come. In many cases he would get a better return from his phosphates, particularly during the years of grazing, by applying small quantities of lime, but not along with the phosphates. Lime in dry districts should

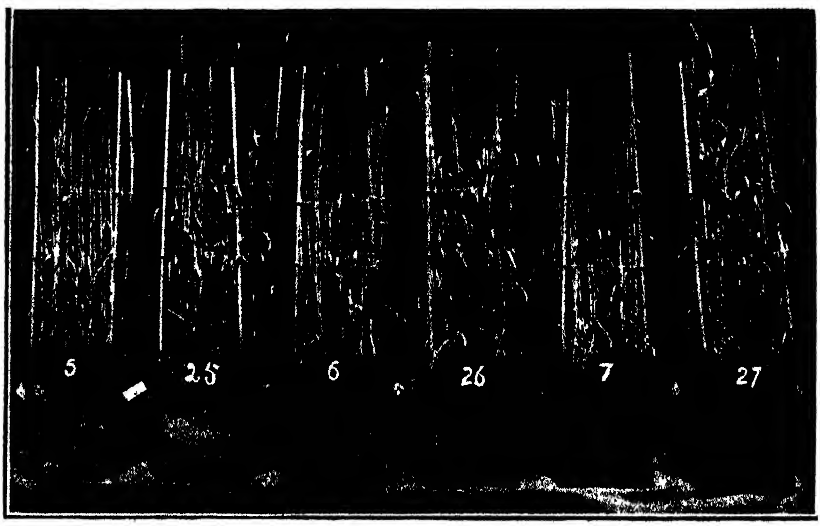


FIG. 5.—BURNLEY EXPERIMENTS.—THE CROPS OF FIG. 4 WHEN MATURE.

be used in small doses, as it probably increases liability to drought. But the cumulative effect will be good.

Victoria, unfortunately, has not disclosed so far workable deposits of calcium rock phosphate, but it has fairly extensive deposits of wavellite (phosphate of alumina). The experiments of Wheeler, and the benefits of lime upon these insoluble phosphates (which could be corroborated from numerous sources did time permit), point to the conclusion that wavellite burned with limestone, and ground, might make a useful fertilizer. We hope that the sundry points touched upon will at all events draw attention to the extreme importance of studying the phosphate supply of local soils. Much of the comparative infertility of the grazing land is due to deficiency of available phosphates. In conclusion, we repeat the suggestion previously made, that systematic investigation as to the best means of applying phosphates to cereals should be undertaken before the most profitable quantity for ordinary farm practice can be finally decided.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 150.)

By S. A. Cock, Orchard Supervisor, Bendigo.

PART II.—VARIETIES.

The Citrus family includes the Orange, Lemon, Citron, Lime, Shaddock, Pomelo, and Bergamot. It is a genus of plants belonging to the natural order (Aurantiaceæ), and consists of trees and shrubs, which are probably natives of India and other warm parts of Asia, many of which are now cultivated in all warm and temperate countries on account of their fruit. The wild state of the Orange is not definitely known, although its character may be fairly confidently inferred from the degeneration of cultivated varieties. Its tendency to degenerate is remarkable, and very few seedling Oranges are of any commercial value. Hence there are many types, such as—

Seedlings, raised indiscriminately from seed.

Modified seedlings, raised by natural cross pollination.

Hybrids, raised by a crossing of two forms differing in character.

Citrus Aurantium (Linné).

The Orange in its widest application. General characteristics: Tree, evergreen; size, moderate; branches, with spines; leaves, compound; petiole, winged; point of union marked by articulation; fruit, pulpy; rind, spongy; oil cysts of rind, concave and convex.

Varieties.

Citrus bigaradia (Duhamel).

The Sour Orange. Characteristics: Branches, very spiny; petiole, winged; flowers, large and highly perfumed; staminate (male organs) and pistillate (female organs) qualities strongly developed; fruit, sour and acid; rind, bitter; oil cysts of rind concave; tree of medium growth, extremely hardy, and on this account largely used for purposes of stock. From this species (*Bigaradia or Vulgaris*) all other varieties are supposed to have sprung.

Type.—Common Seville. Plate 5. Fruit, large, flattened at blossom and stem ends; rind, deep orange, rough, thick; flesh, juicy, yellow, sour acid; seeds, numerous; divisions, regular; rag, very loose in centre. Use: Fruit, marmalade; flowers, Neroli oil.

Citrus bergamium (Risso).

The Bitter Orange.—Tree, small to medium; branches, spiny; leaves, elongated; flowers, small, white, and highly perfumed; rind, oil cysts concave.

Type.—Sweet Seville. Plate 6. Fruit, small to medium, flattened: rind, light orange, smooth and thick; flesh, bitter; divisions, regular; rag, very open in centre. Use: Marmalade, and Oil of Bergamot from the rind.

Note.—On page 149 (Plate 4) plan of irrigation block, scale should read 20 chains to 3 inches.

Citrus decumana (Linné).

The Shaddock.—Tree, quick grower and large; leaves, large; petiole, largely winged; fruit, pear-shaped and of exceptionally large size; flesh, greenish, and bitter acid; seeds, large; skin, thick, pale yellow, and very rough. Use: The Shaddock is worthless commercially, but the tree itself is very ornamental, and its large fruit, of which the Forbidden Fruit is a variety, is used only as a novelty, or for decorative purposes.

Citrus pomelanus (Willd).

The Pomelo.—Tree, rapid grower; leaves, large; petiole, winged; flowers, large and white; fruit, round or pear-shaped; rind, fairly thin, smooth, pale yellow; flesh, pale yellow, with agreeable flavour.

Types.—Triumph Pomelo. Plate 5. Fruit, large, slightly pear-shaped, firm, and heavy; rind, pale yellow, very smooth, fairly thin; flesh, firm, fine, delicately bitter, and slightly acid; seeds, numerous; divisions, fairly regular; rag, loose in centre. Use: Marmalade.

March Seedless.—The grape fruit of America. The following description was given to me by W. J. Stover, Esq., of Shepparton, who came to Victoria with the American irrigation visitors:—

Origin, Florida.

Type of tree, very strong grower, heavy and sure bearer; fruit, hangs in clusters, hidden in the foliage; period of ripening, lengthy; type of fruit, larger than Navel Orange, and pear-shaped; skin, pale yellow, fairly thin; flesh, very fine, and deliciously agreeable. Ranks equal with Navel Orange in value as regards prices obtained for Navels in America, and is now being largely planted in California for home use and export, and is very largely used in the United States as breakfast dessert, for which purpose it ranks equal to pineapple.

Citrus trifoliata (Linné).

A deciduous Japanese species, of dwarf habit, used for stock in very wet situations and heavy soils. Results in this State unsatisfactory.

Citrus Japonica (Thunberg).

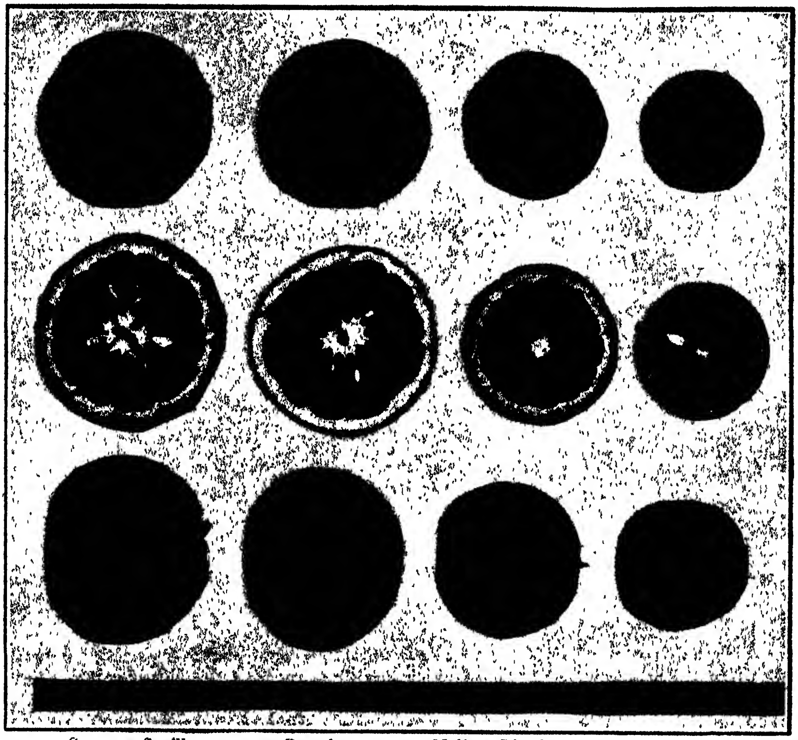
The Kumquat.—A shrubby tree of dwarf habit, with fruit the size of a large grape; rind, sweet; flesh, acid; makes an excellent preserve, preserved whole.

Types.—Round Kumquat, Oval Kumquat, Flat Kumquat.

Citrus Nobilis (Loureiro).

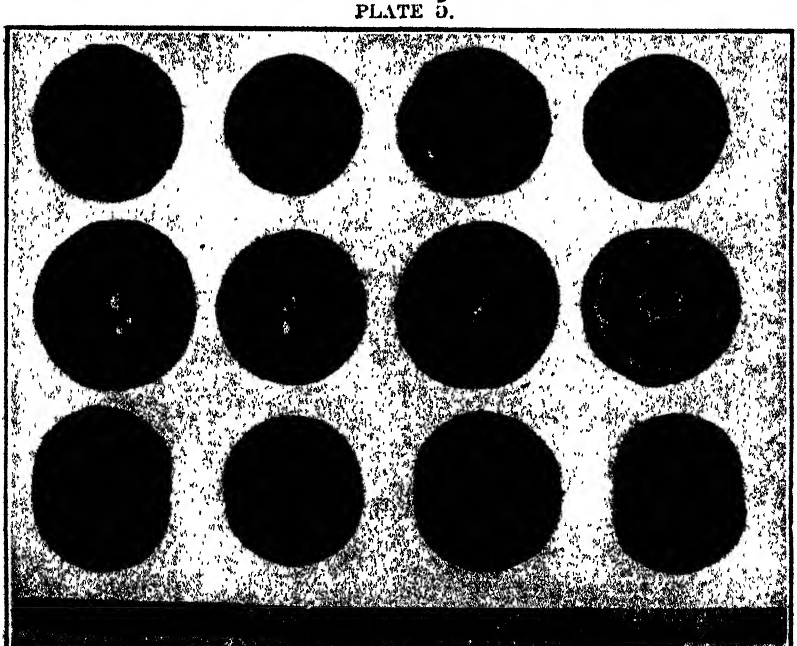
The Mandarin Orange; tree, small to medium; leaves, small, and very narrow; petiole, slightly winged; flowers, white; fruit, generally small and flattened; skin, thin and easily detached from the flesh.

Types.—Dancy Tangierine, Plate 7; fruit, medium, very flattened and depressed; rind, deep orange red, very thin, loose, and easily detached; flesh, juicy, sweet, and fragrant; seeds, few; division, very loose and regular; rag, very loose in centre. Use: Dessert. Tree good bearer.



Common Seville. Pomelo Maltese Blood. Ruby Blood.

PLATE 5.



Homosassa. Paramatta. Mediterranean Sweet. Sweet Seville.

PLATE 6.

Citrus Nobilis—continued.

Emperor Mandarin. Plate 7. Fruit, firm, medium, flattened; rind, orange, loose, thin, and easily detached; flesh, sweet, juicy, and melting; seeds, fairly numerous; divisions, loose, regular; rag, very loose in centre. Use: Dessert. Tree good bearer.

Thorny Mandarin.—Fruit, small, solid, and sweet. Tree, good bearer.

Beauty of Glen Retreat.—Fruit, good flavour. Tree, good bearer.

Citrus dulcis (Volkamer).

The Sweet Orange.—Trees usually of strong growth; leaves, large, oblong; petiole, winged; branches, with but few spines; flowers, white; staminate qualities, weak; fruit, round or oval; oil cysts of rind, convex. Use: Fruit, dessert; flowers, Neroli oil.

Types.—Old Mildura Seedling. Plate 8. Fruit, slightly pear-shaped, medium, firm; rind, pale orange, smooth, thin; flesh, melting, fine, and sweet; seeds, few; divisions, regular; rag, slightly loose in centre.

Wolfskill's Best. Plate 8. Fruit, round, medium, firm; rind, pale orange, smooth, thin; flesh, fine, juicy, sweet, and good flavour; seeds, few; divisions, regular; rag, somewhat loose in centre. Mr. F. W. Pickering, Old Mildura Estate, who kindly supplied me with all the types photographed, states—"This variety is a wonderfully consistent bearer, of most prolific crops, an advantage being the even size of the fruit, running, as it does invariably, about 12 dozen to the bushel case—a size favoured by the trade."

Jaffa. Plate 8. Fruit, egg shape, medium, firm, and heavy; rind, dark orange, fairly smooth, fairly thick; flesh, fine, juicy, and sweet; seeds, few; divisions, very regular; rag, loose in centre. Tree, thrifty, good bearer.

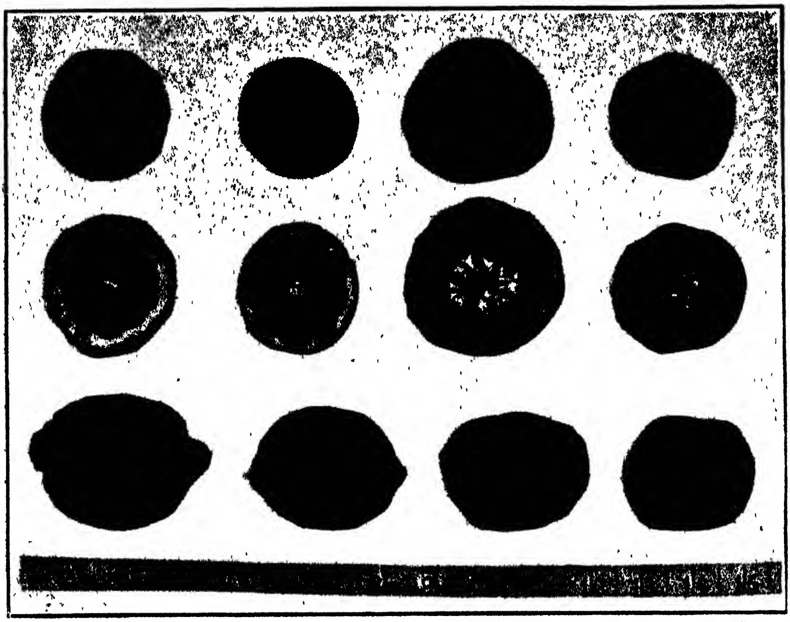
Valencia Late. Plate 8. Fruit, oblong, medium, firm; rind, pale orange, smooth, thin; flesh, melting and juicy; rag, loose in centre; seeds, very few. Tree, good bearer, thrifty; latest variety grown. Fruit will hang a long time on the tree.

Azorean St. Michael. Plate 9. Fruit, medium to large, almost round, slightly flattened at blossom end, firm, heavy; rind, orange, smooth, thin; flesh, melting, juicy, good flavour; seeds, fairly numerous; rag, slightly loose in centre. Tree, an excellent bearer, and regular.

Egg-shape St. Michael. Plate 9. Fruit, egg-shape, medium, firm; rind, deep orange, fairly smooth, and very thin; flesh, fine, juicy, sweet; seeds, few; divisions, regular; rag, slightly loose in centre.

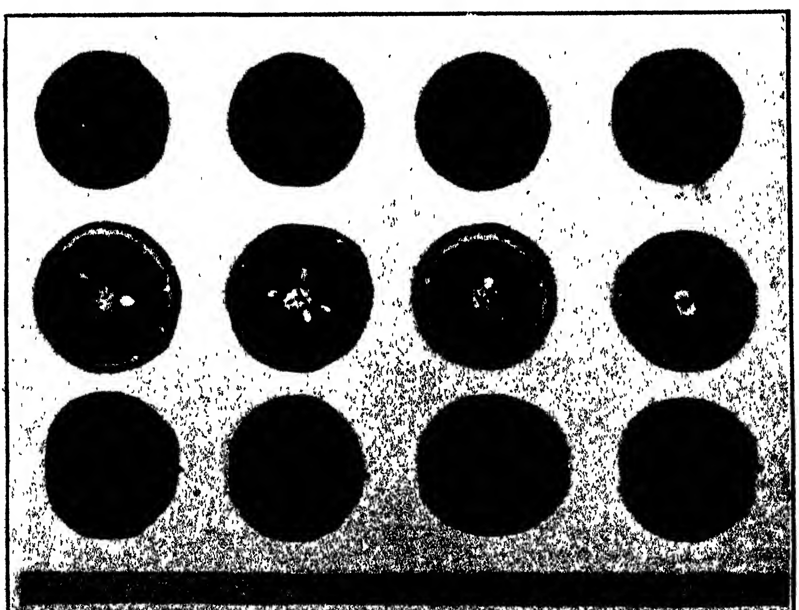
Paper Rind St. Michael. Plate 9. Fruit, small to medium, round, very firm; rind, orange, smooth, thinnest-skinned orange grown; flesh, fine, juicy, sweet; seeds, few; divisions, regular; rag, firm in the centre. Tree, good bearer.

St. Michael. Plate 9. Fruit, medium, round, firm; rind, pale orange, smooth, thin; flesh, fine, juicy, good flavour; seeds, fairly numerous; rag, firm in centre; divisions, regular. Tree, shy bearer in some localities.



Eureka Lemon. Lisbon. Dancy Tangierine. Emperor Mandarin.

PLATE 7.



Old Mildura Seedling. Wolfskill's Best. Jaffa. Valencia Late.

PLATE 8.

Citrus dulcis—continued.

Homosassa. Plate 6. Fruit, almost round, flattened slightly at blossom and stem ends, medium to large, firm, heavy; rind, deep orange, fairly smooth, fairly thin; flesh, melting, good flavour; seeds, few; divisions, regular; rag, firm in centre. Ripens early.

Parramatta. Plate 6. Fruit, round, medium, firm; rind, deep orange, fairly smooth, fairly thin; flesh, fine, juicy, sweet; seeds, fairly numerous; divisions, regular; rag, firm in centre. Tree, thrifty, good bearer.

Mediterranean Sweet. Plate 6. Fruit, round, medium to large, firm; rind, orange, smooth, fairly thin; flesh, fine, juicy, good flavour; divisions, regular; seeds, few; rag, slightly loose in centre. Tree, good bearer.

Washington Navel. Plate 10. Fruit, more oblong than round, large, firm, heavy, with Navel marking at blossom end; rind, deep orange red, very smooth, and thin; flesh, melting, juicy, and excellent flavour; seedless; divisions, slightly irregular; rag, firm in centre. Tree, an excellent bearer, thrifty. Undoubtedly the king of oranges. Mr. F. W. Pickering, in writing of this orange, states—"I would like you to draw especial attention in your article to the advisability of cultivating the Washington Navel variety. Common oranges do not pay to export, but I am convinced there is a tremendous future before the growers of Washington Navels for export."

Thomson's Improved Navel.—Fruit, large, firm; rind, smooth, thin; flesh, melting and sweet; a very excellent Navel type.

Golden Nugget Navel and Golden Buckeye Navel.—Both recent introductions from California, and well spoken of.

Navelencia.—A cross of the Valencia Late and Thomson's Improved Navel; quality, good; fruit, late in ripening. Tree of good growth.

Australian Navel. Plate 10. Fruit, large, oblong, Navel marking large and prominent; rind, deep orange, rough, and thick; flesh, juicy, excellent flavour; seeds, occasionally; divisions, fairly regular; rag, very loose in centre. Tree, very shy bearer.

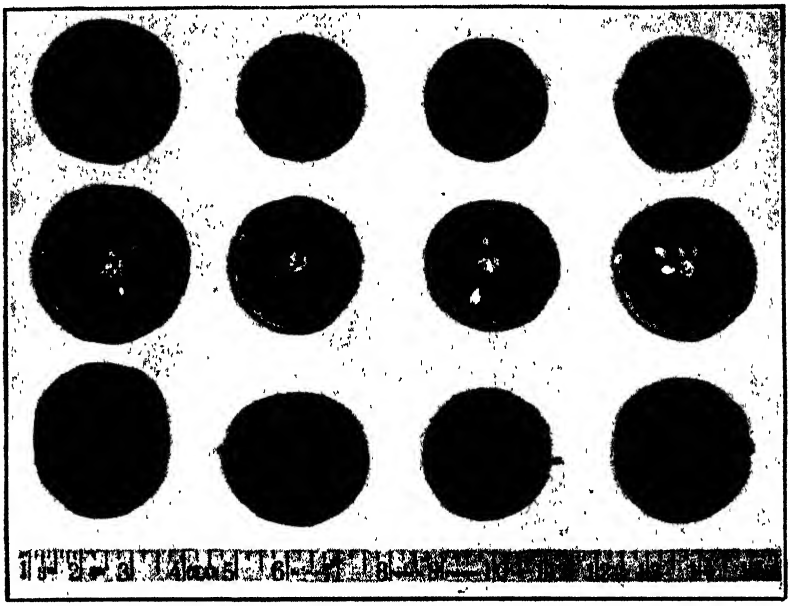
Siletta. Plate 10. Fruit, round, medium, firm, and heavy; rind, pale orange, smooth, fairly thin; flesh, fine, juicy, and excellent flavour; seeds very few; divisions, regular; rag, firm in centre. Tree, good bearer.

White Siletta.—Rind, pale orange, smooth, and thin; flesh, fine, juicy, good flavour; early.

Queen. Plate 10. Fruit, round, medium, firm, heavy; rind, pale orange, smooth, thin; flesh, melting, juicy, good flavour; seeds, few; divisions, very regular; rag, slightly loose in centre. Tree, an excellent bearer, thrifty.

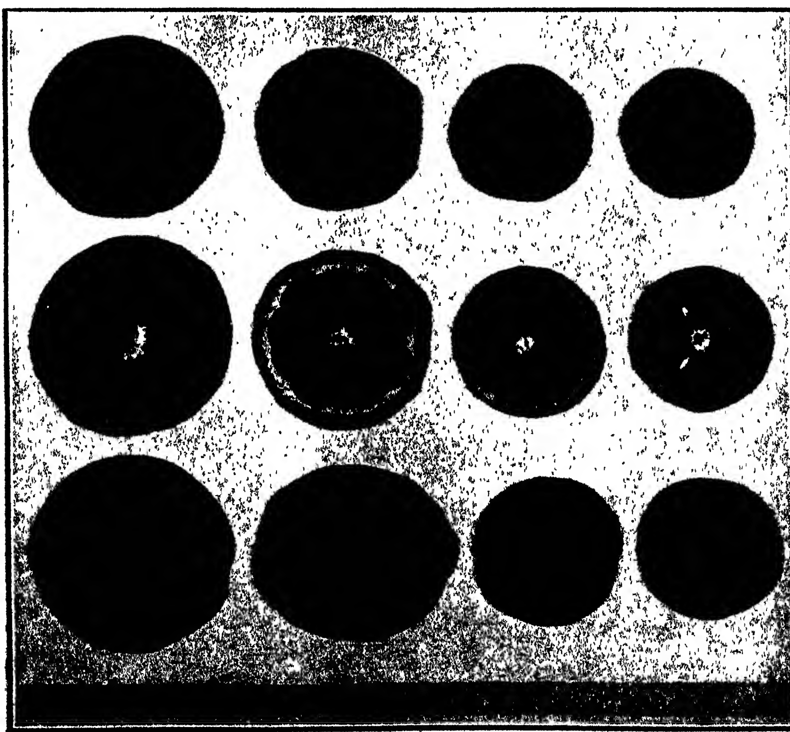
Joppa.—Tree, thrifty, excellent bearer; fruit, medium, firm, good quality.

Maltese Blood. Plate 5. Fruit, round to oval, medium, firm, heavy; rind, deep orange, with red blush on surface, fairly smooth, somewhat thick; flesh, fine, juicy, sweet, marked with a vinous red; seeds, few; divisions, regular; rag, solid in centre. Tree, good bearer, early.



Azorean St. Michael. Egg-shape St. Michael. Paper Rind St. Michael. St. Michael.

PLATE 9.



Washington Navel. Australian Navel. Silletta. Queen.

PLATE 10.

Citrus dulcis—continued.

Ruby Blood. Plate 5. Fruit, small, oval, firm, and heavy; rind, deep orange, with red mottled blush, smooth, and thin; flesh, melting, juicy, vinous red, with pleasing aromatic flavour; seeds, few; divisions, very regular; rag, solid in centre. Tree, good bearer, early.

3 1 2

PLATE 11.—ECHUCA SEEDLING.

Echuca Seedling. Plate 11. Fruit, round, large, heavy; rind, deep orange, rough, thick; flesh, fine, juicy, good flavour; seeds, numerous; divisions, regular; rag, loose in centre. Tree, very prolific, and regular cropper, thrifty, and very hardy. Raised at Echuca thirty years ago. From its habit and general characteristics, should prove a most useful tree for stock purposes.

Fig. 1.—Habit of producing fruit in clusters.

Fig. 2.—Blossom end of fruit.

Fig. 3.—Cross section of fruit.

Citrus Medica (Linné).

The Citron tree in its widest application. A native of Southern Asia.

General characteristics.—Tree, of medium size; branches, with spines; leaves, oblong; petiole, winged; fruit, oblong; rind, thick and tender, wrinkled or furrowed; oil cysts generally concave; flesh, firm and acid; flowers, large, streaked, and reddish on outside.

Varieties.

Citrus limonum (Risso).

The Lemon.—Tree, rapid grower, prolific bearer; branches, with spines; leaves, pale green; petiole, but slightly winged. Use: Pulp for lemon juice and citric acid, and rind for candied peel.

Types.—Lisbon. Plate 7. Fruit, medium, oblong, firm, heavy; rind, pale yellow, smooth, thin; flesh, fine, firm, and acid strong; seeds few; divisions, regular; rag, firm in centre. Tree, heavy, and constant bearer.

Eureka. Plate 7. Fruit, oblong, medium to large, firm; rind, pale yellow, wrinkled, and thick; flesh, fine, and pleasantly acid; seeds, few; divisions, regular; rag, loose in centre. Tree, medium bearer. Fruit keeps well.

Citrus limonum—continued.

Villa Franca.—A summer-bearing variety; a very shy bearer; tree, very delicate; fruit, oblong; rind, thin; flesh, fine and acid.

Variegated (Lisbon).—Leaves variegated; tree, shy bearer; fruit, oblong; rind, thin; flesh, fine, and pleasantly acid.

Citrus limetta (Risso).

The True Lime.—A tree of straggling habit, low growth, and delicate; fruit, smaller than the Lemon; branches, with spines; rind, yellow, thin, wrinkled, and furrowed; flesh, fine, and acid. Use: Marmalade, lime juice, and citric acid.

Types.—Tahitian: Tree, strong grower, prolific bearer; fruit, fairly large; seeds few. East Indian. West Indian. Persian, or Sweet.

Citrus cedra (Gallesio).

The Citron.—Tree, fairly strong grower; leaves, oblong and serrated; fruit, oblong, large; rind, lemon colour, very thick, and tender, furrowed, rough, and warted (in some varieties smooth); flesh, fine, and sub-acid. Use: Candied and preserved peel from the inner rind. Probably the primal type of the species which produced the Lemon and the Lime.

Types.—Lemon, or Sorrento, the variety chiefly grown. Lyman, also a good variety. Bengal. Knights.

(*To be continued.*)

A PROFITABLE FARM.

By R. R. Kerr, Dairy Supervisor.

During a recent trip to Darnum, the farm of Mr. J. Gaul was visited. The farm contains 140 acres, together with about 100 acres rented, and consists of hilly ground and rich flats along the Moe River, and is well adapted for successful dairy farming.

The casual observer is at once struck with the signs of enthusiasm and prosperity that mark the farm of the successful dairyman, and his great faith in the industry. Much of the success on this farm is due to the hearty co-operation of Mr. Gaul's family, the work being proportioned amongst them. All the milk is converted into cheese for sale in the neighbouring towns and Melbourne. At present 72 cows are being milked, and yield 176 gallons a day, or an average of 2½ gallons per cow, which means, with cheese at 8d. a lb., a return of £2 10s. a month per cow. Last year 65 cows and heifers were milked, and made on an average 671 lbs. of cheese, at 6d. a lb., and, after deducting expenses in cheese-making, left a return of £16 1s. 3d. per cow. £100 was made out of pig-raising, and 20 calves from the best cows were reared, the owner refusing £2 10s. a head for them.

Mr. Gaul is a firm believer in the necessity of having one of the true dairying breeds, and not the so-called dual purpose cow, thus preventing the elements of the beef-producing interest from creeping into his dairy herd. He is of opinion that one can well afford to give the good cow away when her milking days are over; the two or three pounds

extra one receives for the beefy animal, when dry, in no way compensates for the increased production during lactation from the true dairy cow. The Ayrshire type predominates in the herd, pure Ayrshire bulls being used. Culling is systematically carried out.

Twenty-five acres of oats were grown for hay, and 25 acres of millet for summer feeding, this latter being mainly grazed by the cows, though portion was cut for hay. This was chaffed with oaten hay, and, a little branning added, steamed and fed to the cows during the winter months—Mr. Gaul saying, "Feed is half the breed." The above results go to prove what can be accomplished by a little intelligent effort on the part of an energetic man, and serve as an example to the dairy farmers in general.

A NEW INSECT PEST TO ROSES.

"THE VINE CURCULIO" (WEEVIL).

Orthorrhinus Kluggi, Sch.

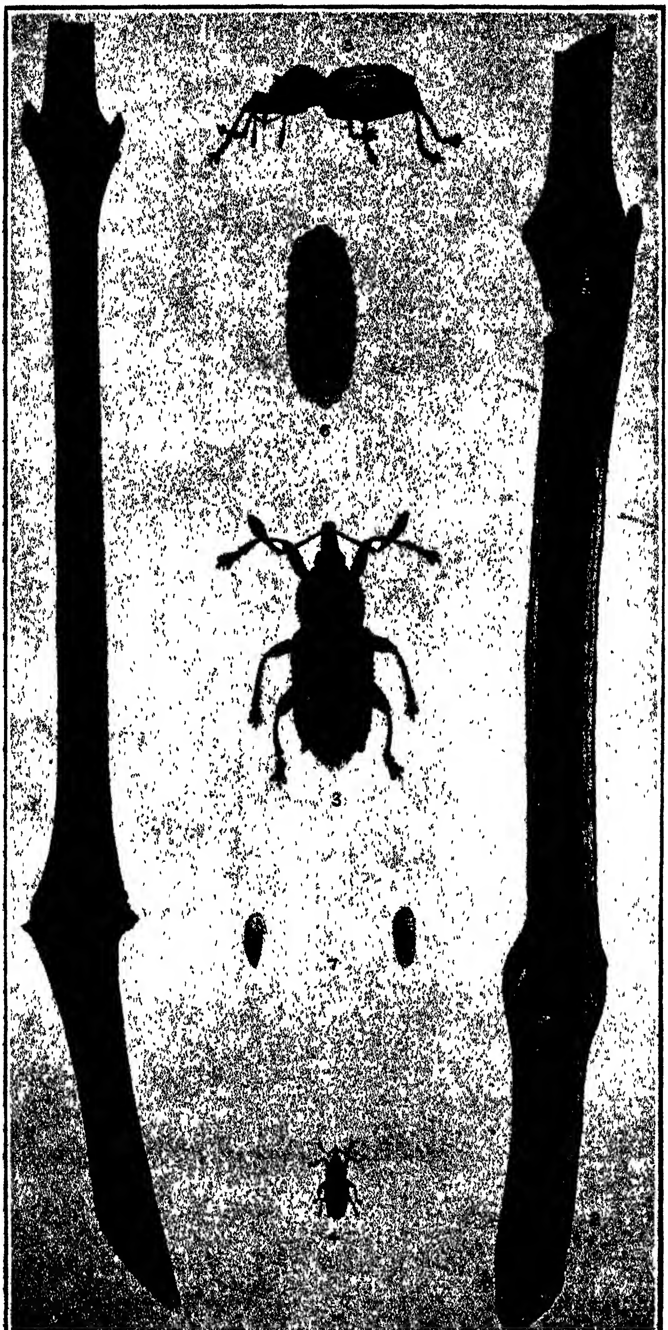
By C. French, Jun., Acting Government Entomologist.

This insect, the natural food of which is the Wattle (Acacia), is common in most parts of the State. During recent years it has been proved that sometimes these insects forsake their natural food and turn their attention to vines, causing considerable losses to the grower. Not content with causing damage to vines, the insects have commenced to attack roses. In July last, a correspondent residing at Horsham forwarded some rose stems which were being killed by insects. I examined the stems, and found them to be badly infested with the larva of a weevil. This being the first time I had seen weevil larvæ in rose stems, I was unable to identify the insects until I bred them out. Early in December last the perfect insects emerged, as many as six coming from a stem 7 inches long.

These insects are of a light-brownish colour, the wing cases have white tips and a greyish-white patch on the middle. The male insect is about 3 lines in length, while the female is about 3½ to 4 lines. The female deposits her eggs on the stems of rose and vine plants. When the eggs hatch out the young larvæ at once commence to bore into the stems, and soon reduce the pith to sawdust.

Mr. E. E. Pescott, Principal, School of Horticulture, Burnley, informs me that at Diamond Creek, in 1909, he saw these insects on the young terminal twigs of Jonathan apples and apricots.

As the insects deposit their eggs on the outside of vines and roses, it would be necessary to spray the plants with a deterrent such as coal tar water, the formula for which is as follows:—Boil 1 lb. of coal tar in 2 gallons of water, and while hot add from 50 to 100 gallons of water. Benzole emulsion might also be tried. This is a patent preparation, and can be purchased at any of the leading seed shops in Melbourne. One 1-lb. tin, when diluted, makes 5 gallons of spray. The smell of the benzole remains on the plants for days. All dead or dying acacias growing in close proximity to a garden should be destroyed by burning.



THE "VINE CURCULIO" (ORTHORRHINUS KLUGGI, SCH.).

BEE-KEEPING IN VICTORIA.

(*Continued from page* 144.)

By F. R. Beuhne, Bee Expert.

XIII.—HONEY.

Honey is the nectar of flowers which has undergone chemical changes during and after the gathering by the bees.

It is composed principally of two sugars, dextrose and levulose, and water. Several other sugars are also usually present, as well as formic acid, tannic acid, albumen, and the essential perfumes of the blossoms from which the nectar was gathered. It is the presence of these essential oils which produces such a great variation in the aroma and flavour of different honeys. All honey is liable, sooner or later, to candy, or granulate; it becomes first cloudy and gradually partially or wholly solid.

Of the two principal sugars composing honey, dextrose is a crystallizing and levulose a relatively non-crystallizing sugar, and the preponderance of the one or the other governs the rapidity and degree of crystallization; while the variation of the greater quantity of one or the other is due to the flora from which the nectar was gathered by the bees. There are, however, some other minor factors which hasten or retard granulation. These are temperature, amount of water, pollen grains, and air bubbles. Honey does not as a rule granulate till the approach of cool weather, and that gathered during cool weather granulates sooner and firmer than honey produced in midsummer. Any honey, however, will granulate sooner under frequent changes of temperature than when kept at a uniform degree, high or low.

The amount of water present in honey varies according to the source of the nectar, the humidity of the atmosphere at time of gathering, and the length of time it remained in the hives. In Victorian honey it ranges from 12 to 25 per cent., the average density being 15 to 17 per cent. When exposed to the atmosphere, the percentage of water will adjust itself to the humidity of the air; thus honey from the dry districts of the State, unless kept hermetically sealed, absorbs water from the air in the city sale-rooms and becomes quite thin on the surface during moist weather. As water is necessary to crystallization, the thinner honeys naturally granulate more readily than the dense honeys from dry districts. Some of the latter remain liquid for one or two years. Particularly is this the case with yellow box and red box honey, which, if it could be obtained entirely free from admixtures of other kinds, would probably remain liquid indefinitely.

Pollen grains, which are always present in honey, have no doubt some influence in the granulation by acting as nuclei of crystallization. At any rate, it is certain that the honey from plants producing abundance of pollen for bees, such as the redgum, grey box, and stringybark eucalypts, and white clover, cape weed, and native dandelion, granulates very quickly; while that from yellow and red box, producing little or no pollen for bees, remains liquid for a long

time. When the modern method of removing the honey from the combs by centrifugal action was first adopted, it was soon found that the air bubbles incorporated in the honey by this process caused it to granulate sooner than when the old method of crushing the combs and straining was practised. How to remove this incorporated air, and to delay granulation generally, will be dealt with in a succeeding chapter.

EXTRACTING HONEY.

Extracting the honey from the combs is in itself a simple enough operation, consisting in first slicing the wax cappings off the sealed honey-comb by means of an uncapping knife, then placing the frames, two, four, or more at a time, upright into the comb-baskets of one or other of the various styles of honey extractors, when by turning the crank handle the baskets are revolved round a central shaft inside a tin can, and the honey is thrown out from one side of the

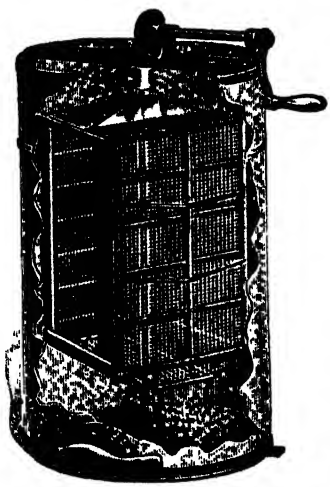


FIG. 1.—NOVICE EXTRACTOR.

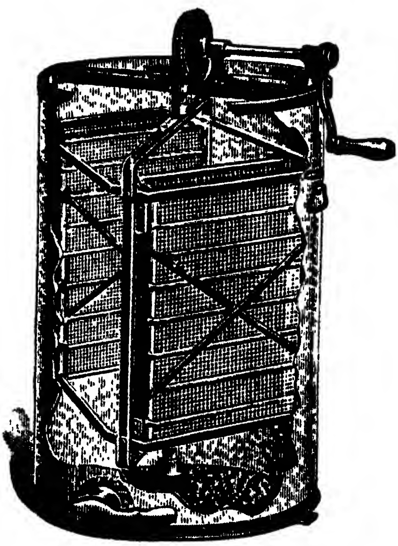


FIG. 2.—COWAN 2-FRAME EXTRACTOR.

comb against the side of the can by the centrifugal force produced. The combs are then reversed; in the smallest kind of extractor (The Novice), as shown in Fig. 1, the combs have to be lifted out and re-inserted with the opposite side facing out. In the Cowan two-frame extractor (Fig. 2), each of the comb-baskets is swung round without removing the comb; while in machines of four or more comb capacity the baskets are connected by a sprocket chain (Fig. 3), and the reversing of one will reverse all the combs. In the latest type of extractor the reversing of the driving gear automatically reverses the combs. In large apiaries in the best honey districts petrol engines are used to drive the extractors, the reversing action being obtained by means of the slip gear, which causes either the one or the other of the bevelled cog wheels seen on top of the extractor in the illustration (Fig. 4) to grip the horizontal cog of the centre shaft, and thus drive the reel with the comb-baskets in either a right or

left hand direction, the comb-baskets being automatically reversed at the same time. By using a power-driven extractor, cappings melter, honey ripener, and a system of gravitation from the extractor to the settling tank, three men can easily take 1 ton of honey in a day of ordinary working hours. As it often happens during heavy honey flows that there are days when, owing to strong wind, extreme heat or cold, no honey can be taken off the hives, and yet the bees continue to bring it in notwithstanding these drawbacks, it becomes necessary to get a maximum of extracting done while conditions are favorable for this operation, so as to provide storage room for the bees and to prevent them gluttoning the brood combs with honey. With several hundred colonies in a good locality, the additional yield obtained will more than cover the cost of engine, reducer, honey heater, &c., in one season.

For apiaries of up to 100 colonies in ordinary average localities, a Cowan two or four frame extractor, driven by hand (Figs. 2 and 3),

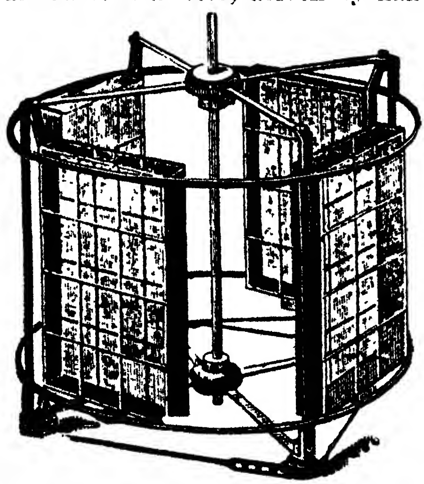


FIG. 3.—REEL OF FOUR COMB REVERSIBLE EXTRACTOR.

will be sufficient. When only a few colonies are kept, without any prospect of increase owing to the character of the locality, a Novice extractor (Fig. 1) will answer all requirements. To any one, however, commencing bee-keeping anywhere with the intention of gradually increasing the number of hives and moving to a suitable locality I would recommend obtaining a two-frame Cowan reversible at the start, as the difference between it and the Novice is not more than 10s. to 12s. 6d.

Whatever kind of extractor is used, the same general rules will apply; but it should be borne in mind that the smaller the diameter of the extractor the faster it has to be turned to remove the honey from the combs, and the more liable are the latter to fracture, because the nearer the comb is to the centre shaft the more divergence there is in the direction of the centrifugal force acting on the comb at different points.

When inserting uncapped combs into the extractor-baskets or withdrawing empty ones, it should be done without brushing against

the wire screen, otherwise the cells will become burred, preventing the honey coming clean out of the cells, and causing unnecessary work to the bees. This bruising of the cells will also occur in uncapping the combs when the combs are tough and the knife blunt. The uncapping knife should be as sharp as a razor. Extracting combs should be straight, and present an even surface after being uncapped, so as to rest evenly against the wire screen of the extractor-baskets.

Before extracting is commenced the honey should be properly ripe.

Unripe honey is inferior in density and flavour, granulates sooner, and, when too thin and containing tannic acid, will even become very dark when it comes in contact with iron. Most Australian honeys contain tannic acid in traces; but, when properly ripe, the acid does not act on the iron of the tins. No general rule can be laid down as to when honey is ripe; it depends upon the source from which

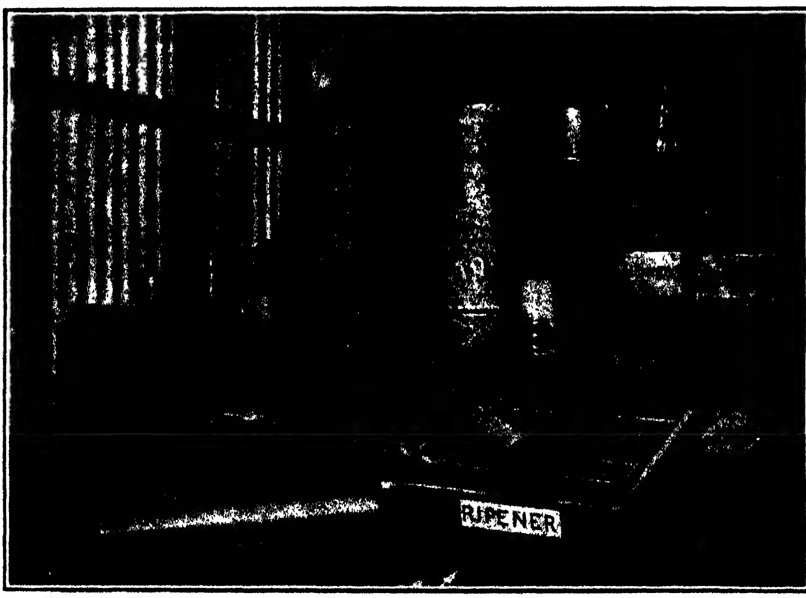


FIG. 4.—EXTRACTING PLANT OF LARGE MODERN APIARY.

the bees gather the nectar and the degree of humidity of the atmosphere at time of storing by the bees.

While honey from different plants varies considerably when fully ripe in the percentage of water it contains, ripe honey from one and the same source, but gathered in different localities, or even in the same locality, but under different atmospheric conditions, will contain water in varying proportions.

During the summer months, in districts north of the Dividing Range which have a rainfall not exceeding 30 inches, honey is considered ripe when the combs have one-half to two-thirds of their surface capped over by the bees. In the country south of the Divide, and in districts with a heavy rainfall, it is better to leave the combs on the hives till nearly capped all over. This also applies to the northern districts during early spring and late autumn.

On the other hand, during very dry weather honey may become over-dense and difficult to extract, even when not sealed. This sometimes occurs when a cold change, without rain, follows hot weather with a good honey flow. It is always best not to take off honey when the weather is cold, unless it is unavoidable. The combs must then be stored, and the extracting done in a warm room.

Beginners often have difficulties through damaging the combs whilst in the extractor. This may result from several causes; the honey in the combs may have been too cold, the extractor may have been turned too fast at the start, the combs may have been too warm and soft, or the frames may not fit evenly against the wires of the extractor-baskets.

It must here be pointed out that there is at least one kind of honey which cannot be removed from the combs by extracting; it is that gathered from one of the ti-trees (*Leptospermum scoparium*) found

FIG. 5.—AN APIARY IN IDEAL BEE COUNTRY.

near the coast and in wet places elsewhere. In some localities it is known as wild may. The honey from this plant is very dark, strong-smelling, and rank in taste, and fit only for manufacturing purposes. The class of country producing this kind of honey should be avoided by bee-keepers. When, however, it occurs in belts in some of the best redgum and box districts, it provides a valuable stand-by for the bees during the "off" season. This honey, although it appears very dense, really contains a high percentage of water, but after being stored in the cells it sets like jelly, so that it can be removed with a pin in one piece. The only way of getting it from the combs is to cut them out, and melt and separate in a cappings reducer; better use can, however, be made of it by reserving it for the bees as winter food, provided that it is not the only crop of the locality.

Honey from the red box eucalypt is very dense, and it is almost impossible to extract it without damaging the combs once it has been

allowed to become cold in the combs. In a lesser degree this may also be said of yellow box honey. To extract dense honey without damaging the combs the extractor should be turned slowly till about half the honey of one side of the combs has left the cells; the combs are then reversed and the speed increased till that side of the combs has been emptied. Then the combs are again reversed, when the honey left in the cells on the other side is thrown out.

(To be continued.)

THE VALUE OF FRUIT AS AN ARTICLE OF DIET.

By Dr. J. H. L. Cumpston.

Before any estimate of the value of any particular article of food can be attempted, it is essential to obtain a clear idea of the reasons why food is necessary, of the requirements that a perfect article of food must satisfy, and of the way in which food becomes available for use by the body.

The Reasons why Food is Necessary.

Without discussing too fully the intricacies of the subject, it may be accepted that the discharge of all the functions of the body—the beating of the heart, the processes of thought, the contractions of muscles which cause movements, and so on—can only be accomplished by the expenditure of a certain amount of energy. This energy is provided by a corresponding actual loss of substance by the body tissues Therefore to make good this loss of substance, which goes on incessantly from the moment of conception till the hour of death, and to thus maintain the body in normal working condition, fresh supplies of material must be forthcoming. The food we eat provides the supply. While this actual loss of substance must be made good, there is also during the earlier periods of life a constant growth of all parts of the body. So that the food must be supplied with the double object of replenishing the loss by "wear and tear," and also enabling the body to grow.

The Requirements that a Perfect Article of Food must Satisfy.

In the first place, as has just been said, the substance actually lost must be replaced. So that the first point to be considered is to ascertain quite clearly what substances are lost from the body as a result of the performance of its functions. This has been experimentally investigated, and is now quite decided. The avenues by which the loss occurs are the lungs, the skin, the kidneys, and—to a less extent—the bowels. Analysis of these waste products shows that they consist almost entirely of four chemical elements—carbon, hydrogen, oxygen, and nitrogen—and that the proportions of these various substances remain fairly constant. Therefore, the main problem to be solved is how to supply these four elements in the proper proportions.

Food in the forms in which it is universally taken may be classified under five definite heads, according to its composition. These

groups are named as follow:—Proteids, carbohydrates, fats, salts, and water. Of these, water, a familiar enough substance, plays the most important part. The proteid group is the only one of these which contains the necessary nitrogen, and may be represented by the white of an egg, which is the purest form of proteid among the common articles of diet. The lean part of meat is another example of a proteid form of food. The term "fats" sufficiently explains itself—butter and the fat of meat are common examples. Carbohydrates are a group of substances all alike in chemical composition, but somewhat unlike in the forms in which they are familiar to us. Potatoes, flour, and sugar are all examples of the carbohydrate type of food. Salts form a small portion of food; there are a large number of them, and the most familiar example is ordinary table salt.

So that, in an ordinary breakfast, the chop is the proteid, the bread and the sugar in the jam are carbohydrates, the butter is the fat, the salt is used with the chop, and the water is provided by the tea.

As proteids are the only food substances which contain nitrogen, it is obvious that life could not be maintained unless proteids are taken. Proteids, however, contain less carbon than nitrogen, so that if proteids alone were eaten in order to obtain the necessary amount of carbon, far too much nitrogen would be taken. A mixed diet is therefore absolutely necessary, and for other reasons a mixed diet, such as is usually taken, containing all five groups of substances, has been shown to be the most satisfactory. Science has thus been able to prove in this century that mankind has been eating the proper kinds of food since the beginning of time.

THE WAYS IN WHICH FOOD BECOMES AVAILABLE FOR USE BY THE BODY.

For the food substances to be of any use to the body tissues, to the muscles for example, it must be carried to the muscles by the blood. To get into the blood, it must pass through the walls of the intestines in a liquid or dissolved form. Obviously, in the form in which food is taken into the mouth, it would be absolutely impossible for it to pass through the walls of the intestines. Therefore, the digestive apparatus has been provided. The teeth break up the food into small particles; then the digestive juices in the mouth, stomach, and intestines mix with the food and chemically change it, dissolving it and ultimately converting it in such a way that it can pass through into the blood and be at once available for use by the tissues. It has been long understood that unless each minutest part of the food is reached and acted upon by the digestive juices the process of digestion will not be complete.

Having then considered food in general, it becomes possible now to discuss fruit in particular, and to attempt to estimate the value of this class of foodstuff. In the first place, are the different groups of food substances which have been shown to be necessary contained in fruits, and if so in what proportions are they present? Considering the commoner varieties of fruits—apples, pears, plums, peaches, apricots, cherries, grapes, gooseberries, currants, &c.—it is found that these contain about 85 per cent. of water, a very low proportion of proteids, a moderate amount of carbohydrates, and in addition to these a considerable proportion of vegetable acids and of salts. They contain no

fats. The fact that fruits contain a low proportion of proteids at once makes it clear that fruit would not be sufficient by itself to carry on the work of the body; but as fruit contains carbohydrates, salts, and a large amount of water, it takes its place as a possible constituent in a mixed diet. The fact that the carbohydrates and salts are, to a large extent, contained in the water, *i.e.*, as juice, and are thus present in a readily available form, greatly adds to the value of this form of diet. In short it is evident that fruit by itself is insufficient to maintain life for any prolonged period, that it takes its place along with an infinite variety of other foods as a pleasant and palatable form in which some of the necessary food substances may be taken; but that, unless it can be shown that fruit has in itself a special quality which is not possessed by other foods, then it must be considered that fruit is not an indispensable article of diet.

Has Fruit such a Quality?

Let me remind you of what is a familiar fact—that outbreaks of scurvy on shipboard very rarely occur when the ship is provided with a sufficient supply of fresh limejuice. Without entering at any length into the theory of the question, it may be said that scurvy and some other diseases are probably due to an increase in the amount of acid in the blood, and that this increase of acidity is prevented by the vegetable acids and their salts. Though this appears paradoxical, yet in all probability it is actually so. In any case, whatever be the physiological explanation, the fact remains that the absence of fresh fruit or fresh fruit juices from the diet may lead to serious derangement of health.

In another direction fruit plays a very useful part. If a small piece of meat is placed in the juice of a fresh pineapple, the meat will gradually disappear—it is digested by a special constituent of pineapple juice. This special principle is called a ferment. Such ferments are present in all fresh fruits, and play a very considerable part in maintaining normal health. In still a third direction fruit has a special value. The cells of all varieties of fruit are encased in a fine envelope of woody fibre, known as cellulose. This is indigestible, and without producing the abnormal condition known as indigestion, it stimulates the walls of the intestines, increasing their activity, and so preventing constipation. This tendency is assisted by the large proportion of salts present in the juices, so that fruit is especially valuable in preventing constipation and assisting normal and regular digestion.

There is no doubt then that fruit has a special value as an article of diet, and is therefore practically indispensable. Particularly is this true in tropical and semi-tropical countries. The conditions of life in these countries are such that fruit is of almost inestimable value in the preservation of health. Different climates demand different diets. The Esquimaux find it necessary to consume enormous quantities of meat, and practically no other kinds of food. From this extreme, gradations are observed, until the races in tropical countries live almost entirely on fruit and grain, and have a minimum of flesh foods. In these States the climate is tropical and semi-tropical, and temperate,

and it should be emphasized that here the more fruit a man eats the better will his health be.

A word as to the effect of cooking on fruits. In cooking, the cellulose walls of the cells are ruptured and the cell contents escape, so that it is more easy for the digestive juices to mix with cooked fruit than with raw, and therefore digestion is easier. On the other hand, most of the valuable constituents of fruit are present in the juice, and this becomes largely available during mastication, so that the necessity for perfect digestion is not so great as with some other foods. Further, the effect of cooking is to destroy the ferments, and so one of the most valuable constituents of fruit is lost. Therefore, while cooked and preserved fruits are good, raw fruit is probably a great deal better.

To sum up the position, then: Fruit contains some of the necessary constituents of all foods, and is therefore and by reason of its palatability, of general value; it contains certain special principles which are necessary to the body, and is therefore indispensable; it is of greater value in the raw than in the cooked state; it is of especial value in tropical and sub-tropical countries.

In view of these facts, it is obvious that an abundant supply of fresh fruit, sold at such prices as to be available to all, is an absolute necessity in a place with a climate such as we have.

While the reasons for it may be open to discussion, yet this fact is undeniable, that the price of fruit is maintained at such a level as to place it beyond the reach of those to whom an abundant supply would be most valuable. If it be that the fruit market is being financially exploited by the few to the detriment of the many, then these few should be forcibly reminded that financial exploitation of goods is less defensible when it controls foodstuffs needed by the people than in any other field of operations, and must inevitably bring about its own adjustment. Whatever be the direction in which the reform is called for, it is to be hoped that before long such steps will have been taken that the general public will have been provided with a sufficient supply of wholesome fresh fruit at a reasonable price.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Fruit.

With the exception of the very late varieties, all fruit has now been gathered, and the fruit rooms and stores are all filled with the produce of the orchard. The fruit room should be well ventilated and aired, but all direct currents of air should be avoided, as these will certainly shrivel and dry the fruit. The store room should also be kept as cool as possible. Every care should be taken to keep out of the store room

all fruit infested with any pest or disease. Such fruits should be immediately destroyed, preferably by being cooked for animal consumption.

Such varieties as Rokewood, Schroeder's Apfel, Shockley, Rome Beauty, Stone Pippin, Granny Smith, and Mellon's Seedling are all good keepers, and useful for storage purposes. The latter apple is winning its way among orchardists, and it is a desirable apple for the late local markets. In its natural home, at Dunolly, where it was raised some years ago, it keeps very late, and, in many instances, is quite sound early in November. In other districts, and grown on richer soils, it does not seem to retain its keeping characteristics. Another point in its favour is that at present it has shown no signs of Bitter Pit.

New Pear.

Alama.—Resembling Easter Beurre very much in appearance, with a considerable amount of russetting near the stalk. Greenish-yellow in colour, well fleshed, core small, flavour second rate, fairly mealy, and not a good keeper.

Cultivation and Green Manuring.

The heavy rains of March have made cultivation very easy this season, and growers are enabled to get in early crops for green manuring. As soon as the fruit is off the trees, the land should be well ploughed and left in a rough condition until the spring ploughing.

If not already done, and the orchard conditions demand it, there is still time to put in a leguminous crop for green manuring purposes. But this should be done as early as possible, so as to give the crop a chance to make some good early growth. Soils deficient in lime or in organic matter are always benefited by a crop of green manures. Where stable manure is unprocurable, the green manure crop is the only means of adding any organic matter to the soil.

Pests and Diseases.

All codlin moth bandages should be removed after the ploughing, and burned. It is not advisable to remove them before ploughing, as some larvæ certainly shelter under clods, and in the soil; the cultivation disturbs them and causes them to find a fresh hiding place.

All secondhand and old cases should be thoroughly overhauled. It is preferable to do this work now, instead of leaving it till spring, when the rush of other duties will certainly prevent it being carried out. The cases, if not bad enough to be destroyed by fire, should be dipped for some time in boiling water. And this is not only for the killing of the codlin larvæ, but also to destroy larvæ or eggs of any scale or aphis, and also any spores of fungus diseases that may have found lodgment therein.

As soon as the trees have shed their foliage, they may be sprayed with red oil emulsion for woolly aphis, peach aphis, and the bryobia mite (red spider). And this should be done before pruning, so that in handling and carrying the prunings the pests will not be spread about the orchard to infect the clean portions.

Flower Garden.

The copious rains of March have brightened up the flower gardens wonderfully, and just at this time they should be bright and gay with autumn flowers and foliage. The garden can generally be depended upon to make a good show in the autumn months, provided that the plants have been previously kept in a healthy state by watering, mulching, and feeding. The question of plant foods should be given far more consideration in autumn than at any other time of the year. Not only because the most popular flowers—roses, chrysanthemums, and dahlias—are then in vogue, but more because the soil requires a stimulus and in addition after the trying, heating weather of summer, and also after the leaching or soil washing effects of the frequent summer waterings. So that, in order to impel our rose bushes, our chrysanthemum, and other plants to give their best results, they should be fed weekly with liquid or chemical manures up to the time of blooming. Then the feeding should cease, as the plants require no further stimulus.

The removal of permanent shrubs and palms, and the planting out of evergreen trees, shrubs, and herbaceous divisions should not be delayed any longer. The nursery section of this class should be cleared out into the garden at once. It is a mistake to wait, as many growers do, for the removal of such plants until the winter season. If planted out now while the ground is warm, the roots of the plants have a fair chance to grow, to take a considerable hold of the soil, and to establish themselves in their new location before the growth period ceases. Then, after the winter's rest, they are ready to break away into new growth, both in the roots and crown, with the advent of the first spring weather. When planted in winter they have no chance to grow, the roots remain as when planted and with every chance to rot in the cold wet soil, the foliage becomes yellow and debilitated, and the plant, if it does not succumb, often takes the whole ensuing season to recover its general health. And then, of course, the season that has been lost can never be regained.

Gardens should now be well drained or trenched. This is a feature more often overlooked than otherwise. And yet no garden will produce the results it should produce unless one or both of these very necessary operations are carried out. There is a wealth of plant food and food supplies below the usual digging depth, and gardeners should never neglect to dig down deeply, so that the roots of their plants may have an increased area in which to revel for food and moisture. Deep working is an absolute essential in every garden. It means a saving of water and manures for the grower, and it also means increased growth, health, and blossoms for the plants. The ground should always be well dug to the full depth of the soil once a year, and an occasional stirring of the sub-soil is also invaluable. A mistake often made is that the clay is brought to the surface, and the top soil buried beneath it. Nature's order should never be reversed, and the relationships of top soil, and then sub-soil, should always be recognised. After the autumn digging, the ground may be left in a fairly rough state, as the usual climatic conditions will result in a gradual

weathering down of the surface. The autumnal dressing of lime is always beneficial.

Bulbs, tubers, and corms of spring-flowering plants should now all be planted. As they appear above ground, they should be protected from the ravages of snails and slugs, as these pests have a very great liking for such succulent growths. A good surface dressing of broken leaf or dust tobacco will effectively deal with these pests. In fact, the gardener who constantly uses tobacco, either in the leaf, stem, or dust form, will very soon be in the happy position that slugs and snails will cause him no anxiety whatever. Besides, the tobacco has manurial properties which also are valuable.

Pansy and any other seedlings, also rooted layers and cuttings, may now be planted out into their permanent positions.

Sowings may also be made of any hardy annuals, such as antirrhinum, aquilegia, correopsis, Canterbury bell, dianthus, everlastings, foxglove, gaillardia, hollyhock, larkspur, leptosyne, lobelia, marigold, pansy, petunia, stock, sweet peas, verbena, wallflower, &c.

Vegetable Garden.

There should now be no untidy or undug plots in the kitchen garden. The vacant beds should all be well dug over and prepared for the planting of vegetables for use in spring. In digging, a top dressing of manure should be given; this may be dug in. All weeds, too, may be forked into the trenches, and covered well with soil as each spit or length is dug. A dressing of lime is very beneficial at this time of the year.

A start should now be made at cleaning out the asparagus beds. This vegetable is most popular, and yet one rarely met with in ordinary household gardens. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed plots in the whole garden. Depth of good soil and plenty of manure are all that this plant requires.

In establishing a new bed, it is advisable to see that there is a good depth of 2 or 3 feet of rich, well manured soil. If this is not present, the soil should be dug out to that depth, and thoroughly mixed and enriched with well rotted manure before being replaced. A bed deeply prepared, and supplied with ample quantities of manure, should last without replanting for very many years. The young plants or crowns, should then be planted in trenches, keeping the rows 2 or 3 feet apart. An asparagus bed requires ample and direct exposure to the full rays of the sun. The asparagus should not be cut during the first season after planting. In fact, it is better to allow it to go uncut for two seasons. As little foreign weed growth as possible should be allowed in the beds, but, when they are not producing culinary asparagus, rows of lettuce, beans, radish, &c., may be grown between the crowns.

Towards the end of April the tops may be cut down, the beds cleaned, and a good top dressing of stable manure given. Chemical fertilizers, such as bonedust, sulphate of ammonia, and sulphate of potash, may be given as a substitute to organic manure. In the past

it has been the custom to annually top dress the beds with salt. It was supposed that, as asparagus in its native habitat was usually found in sandy soils near the sea coast, the plant required salt or a saline soil to produce successful results. It has latterly been found that salt is not at all essential to good growth, and that the plant will readily adapt itself, and grow well, in soils of not at all a saline character. Where potash has taken the place of salt, quite improved results followed.

It is a good rule to observe that no ripe seeds should be allowed to fall on to the beds; they should be stripped off the plants before they have a chance to drop. Seedlings will become a nuisance in the beds, and they interfere with the regularity of the rows.

A few early peas, also some broad beans, may now be sown; cabbage, cauliflower, and other seedlings should be planted out from the seed beds. All garden salads, such as thyme, mint, horse-radish, sage, &c., as well as rhubarb, should be divided and planted out where necessary.

Onions seeds for an early crop may be planted out towards the end of the month. Brown Spanish is very hard to beat as an all-round onion, while the new variety of Early Brown Spanish may be relied upon to produce an early crop.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

MONTHLY REPORT ENDED 14TH MARCH, 1913.

H. V. Hawkins, Poultry Expert.

Following my last report, the birds have had a trying time. During the early part of the month great humidity was experienced, which forced many of the hens into an unusually heavy moult, in several cases the birds dropped nearly every feather.

During the latter portion of the period cold weather, accompanied by gusty winds, has not improved the chances of several pens which are among the leading ten. There is no doubt that the variations of temperature during the moulting season have a bad effect on the organs of reproduction, and probably Mr. Brown's team, which has laid a splendid sized egg, and at fairly regular periods, for the past 10½ months, will receive a check; if so, their chance of holding pride of place throughout the competition is reduced, whilst with Messrs. Bradley and Waldon's birds, the moult has been more gradual, and their output has not diminished to any extent. There is evidence of a close finish between the first three pens.

Feeding.—During the cold snap the feed has been given hot in the morning, and at night maize has formed the bulk of the grain fed. The total number of eggs laid to date is 77,806, and the general health of the birds is good.

The competition will terminate on the 14th April, and on the 15th idem the third competition will commence.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition. April 15 to Feb 14.	Feb. 15 to Mar. 14.	Total to Date (11 months).	Position in Competition.
40	White Leghorns	S. Brown	1,318	96	1,414	1
47	,,	J. E. Bradley	1,235	126	1,361	2
20	,,	E. Waldon	1,246	100	1,346	3
31	,,	G. Edwards	1,229	93	1,322	4
25	,,	R. L. Appleford	1,195	118	1,313	5
70	,,	C. J. Beatty	1,184	115	1,299	6
28	,,	F. G. Eagleton	1,198	97	1,295	7
33	,,	H. McKenzie	1,163	125	1,288	8
23	,,	W. McLister	1,178	99	1,277	9
39	,,	W. G. Swift	1,170	107	1,277	
62	,,	R. W. Pope	1,203	73	1,276	11
1	,,	J. Campbell	1,173	102	1,275	12
45	,,	Wooldridge Bros.	1,151	109	1,260	13
13	,,	W. B. Crellin	1,168	78	1,246	14
37	,,	C. R. Bertlesmeier	1,177	63	1,240	15
38	,,	R. Moy	1,133	105	1,238	16
63	,,	Percy Walker	1,126	108	1,234	17
53	,,	H. Hodges	1,131	102	1,233	18
9	,,	J. Spotswood	1,159	74	1,233	
49	,,	W. Purvis	1,142	88	1,230	20
29	,,	J. B. Brigden	1,133	89	1,222	21
5	,,	J. H. Brain	1,089	122	1,211	22
44	,,	A. W. Hall	1,097	113	1,210	23
24	,,	Sargenfri Poultry Yards	1,120	83	1,203	24
48	,,	Griffin Cant	1,118	77	1,195	25
14	,,	J. H. Wright	1,108	83	1,191	26
32	,,	S. Brundrett	1,060	115	1,175	27
50	,,	A. Ahpee	1,072	97	1,169	28
7	,,	A. H. Padman	1,073	95	1,168	29
19	,,	Cowan Bros.	1,057	109	1,166	30
46	Black Orpingtons	H. A. Langdon	1,059	103	1,162	31
10	R.C. Brown Leghorns	S. P. Giles	1,059	98	1,157	32
2	White Leghorns	B. Rowlinson	1,056	96	1,152	33
61	Black Orpingtons	Jas. Ogden	1,057	93	1,150	34
69	White Leghorns	Morgan and Watson	1,050	99	1,149	35
42	,,	Mrs. Kempster	1,054	88	1,142	36
64	,,	H. Merrick	1,049	83	1,132	37
35	,,	C. H. Busst	1,039	92	1,131	38
12	,,	T. H. Stafford	1,019	105	1,124	39
15	,,	Mrs. Steer	1,040	81	1,121	40
6	,,	J. B. McArthur	1,060	56	1,116	41
3	Black Orpingtons	King and Watson	1,006	102	1,108	42
51	White Leghorns	H. Hammill	1,007	91	1,098	43
57	,,	B. Walker	978	112	1,090	44
56	,,	M. A. Monk	1,004	85	1,089	45
65	,,	A. H. Thomson	990	91	1,081	46
43	,,	G. Purton	981	97	1,078	47
30	,,	Mrs. Stevenson	1,024	52	1,076	48
60	,,	Miss B. E. Ryan	975	80	1,055	49
66	,,	J. Moloney	958	83	1,041	50
27	,,	E. Nash	942	89	1,031	51
55	Brown Leghorns	J. Matheson	920	102	1,022	52
4	White Leghorns	J. Blackburne	949	72	1,021	53
11	Black Orpingtons	T. S. Goodisson	957	58	1,015	54
54	White Leghorns	F. R. DeGaris	930	76	1,006	55
16	Silver Wyandottes	R. Jobling	917	87	1,004	56
41	White Leghorns	A. Stringer	928	69	997	57
68	,,	W. J. McKeddie	902	71	973	58
8	Black Orpingtons	D. Fisher	891	57	948	59
21	White Leghorns	J. O'Loughlin	857	72	929	60
58	,,	W. J. Stock	875	48	923	61
67	Anconas	A. E. Manning	834	83	917	62
17	White Leghorns	S. Childs	852	64	916	63
22	,,	W. N. Ling	836	68	904	64
52	Minorcas	Chalmers Bros.	841	61	902	65
59	White Leghorns	W. J. Seabridge	823	79	902	
34	,,	R. F. B. Moore	806	90	896	67
18	,,	B. Mitchell	776	71	847	68
36	Old English Game	K. J. Barrett	761	73	834	69
26	.. ..	(Reserved)	—	—	—	..
		Totals	71,668	6,138	77,806	

REMINDERS FOR MAY.

LIVE STOCK.

Horses.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth.

Cattle.—Cows, if not housed, should be rugged. Rugs should be removed in the daytime when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows about to calve, if over fat, should be put into a paddock in which the feed is not too abundant. Calves should be kept in warm dry shed.

Pigs.—As recommended in Reminders for April.

Sheep.—Lambing ewes should be seen every morning, especially merinoes, if lambing to rams of British breeds. Comeback and first cross ewes commence lambing about now. Wool cleared from front and round the udders of stud merino and Lincoln ewes at time of crutching will allow of lambs getting milk quickly, when lambed in cold weather. Avoid shortage of feed in lambing paddocks, for insufficient feed causes inattentive mothers. Young sheep can now be classed. Inferior fleeced ones should be fattened for rations. Do not leave lamb marking too late. In the case of early prime lambs, the ram lambs should be castrated when a few days old, whenever and wherever they can be caught, no assistant to hold them being necessary.

Poultry.—Feed animal food to forward pullets, about ½ oz. daily, and equal parts short oats and broken maize at night. Add a little lucerne chaff and raw sliced onions to mash daily. Watch young stock for Roup (watery discharge from nostrils, with unpleasant breath). Late chicks are likely subjects. Isolate all cases, and use disinfectants freely. Keep head and throat clean by washing with either Condy's fluid or boracic acid. In cases of Chicken Pox isolate birds and apply to affected parts ointment made of sulphur, eucalyptus oil (three or four drops), carbolic acid (two drops), and a little vaseline mixed well.

CULTIVATION.

Farm.—Dig main crop potatoes. Push on with ploughing and sowing of cereal crops, including peas and beans. Green fodder (as for April) may still be sown. Land for maize, potatoes, and other root crops should be prepared and manured. Flax may be sown. Transplant Chou Moellier and Giant Drumhead cabbage plants in rows 3 feet apart. Complete sowing permanent pastures with grasses and clovers.

Orchard.—Plough, manure; apply lime to orchard lands at rate of 5 or 10 cwt. per acre where soil is sour. Spray trees infested with scale insects, Woolly Aphis, and Bryobia Mite with red oil or crude petroleum. Clean all rough bark from trees. Commence pruning at end of month.

Flower Garden.—Digging, manuring, and pruning; trench and drain where necessary. Dress the surface with lime. Continue to sow hardy annuals. Bury all leaves, soft-wooded cuttings, and weeds. Continue to plant spring blooming perennials and other plants. Plant cuttings of carnations and roses.

Vegetable Garden.—Cut down and clean out asparagus beds. Apply manure and lime dressings. Cultivate deeply. Plant out seedlings and early potatoes; sow peas, broad beans, carrots, and parsnips.

Vineyard.—Subsoil land for new plantations if not already done. It is very undesirable to perform this work immediately before planting. Vine-growers are warned against the too common practice of feeding off foliage after vintage. Any small advantage in the form of stock feed is only gained at the cost of a reduction in the following season's crop, owing to interference with accumulation of reserves, which continues so long as the leaves remain green. Sheep should not be allowed into the vineyard until all leaves have changed colour. Early and deep ploughing is strongly recommended. Manures should be applied as early as possible. The present season is exceptionally good for green manuring; peas, &c., for this purpose should be sown without delay.

Cellars.—Rack or fill up (preferably the former) dry wines as soon as a lighted match, introduced at bung hole, is no longer extinguished. Sweet wines should also be racked and fortified to full strength.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 5. 10th May, 1913.

GOVERNMENT CERTIFICATION OF STALLIONS.

SIXTH ANNUAL REPORT (SEASON 1912) ON THE VETERINARY EXAMINATION OF STALLIONS FOR THE GOVERNMENT CERTIFICATE OF SOUNDNESS AND APPROVAL.

By W. A. N. Robertson, B.V.Sc.

In introducing this, the Sixth Annual Report of the scheme for examination and certification of stallions, it is worth noting the large increase in the number of stallions, particularly of the draught type, introduced into Victoria during the year from the United Kingdom.

For the period ended 31st December, 1912, a total of 91 stallions was introduced. Of this number, 82 were of the draught type, 21 being Clydesdales, and 61 Shires. For the previous year a total of 53 was introduced. From New Zealand a total of 226 stallions was imported, and of these 219 were draughts. This shows a decrease of 35 as against the number imported during 1911. A greater decrease in the number of mares and geldings introduced from New Zealand occurred, the figures being 1910 head less than for the previous year. No doubt this was due in a large degree to the long continued spell of dry weather preceding the July sales, when the demand for workers was not so keen as in previous years. The increase in the importations from the United Kingdom with the decrease in the number of stallions introduced from New Zealand would appear to indicate that there is a desire on the part of breeders to improve their studs by the introduction of English and Scottish blood.

It would, I think, be wise to sound a note of warning to breeders to carefully consider the laws of breeding in order that the blood that has been introduced, and for which such fine prices have been paid, should be kept pure, and so bring the draught horse industry into such a condition that it will be necessary to import at infrequent intervals only. The system of breeding as carried out at opposite ends of the globe stands out in clear contrast, and though the many splendid horses that have been introduced into Victoria in the

past have left their mark on the industry, the colonial bred stallion does not occupy the position that his brother from oversea does, where more careful methods have been followed from generation to generation, resulting in the production of an animal that, when mated with one of similar type, clearly exemplifies the breeding law that "like begets like." The system of breeding indiscriminately from Shires and Clydesdales does not exemplify this law, except inasmuch as in general one horse is like another. In no other class of breeding stud stock are such methods followed, though crossing is at times carried out, but the original pure line of breeding is carried on at the same time so as to continue the strains from which a cross may be obtained.

During the season under review, 161 parades were held. Of this number 94 were carried out under the auspices of various Agricultural Societies, the balance being made up by examinations conducted at sales and under the regulations providing for the special examination of stallions.

EXAMINATIONS AND REJECTIONS.

The total number of stallions examined was 954. Of this number 746 received certificates and 208, or 21.8 per cent., were rejected. This is a very small decrease over the percentage rejected during the previous season.

TABLE 1.

ANALYSIS OF DEFECTS OF REJECTS, SEASON 1912-13.

	Draughts.		Light.		Ponies.		Totals.	
—	Examined.	Certificated.	Examined.	Certificated.	Examined.	Certificated.	Examined.	Certificated.
	745	597	139	106	70	43	954	746
	Rejected.	Per cent. Rejects.	Rejected.	Per cent. Rejects.	Rejected.	Per cent. Rejects.	Rejected	Per cent. Rejects
Unsoundness.								
Sidebone ..	70	9·46	...	...	.	...	70	7·38
Ringbone ...	15	2·03	3	2·16	1	1·43	19	2·00
Spavin (Bone)	3	·4	8	5·76	...	...	11	1·16
Bog Spavin .	...	...		...	..	...	...	...
Curb ...	·1	·13	8	5·76	1	1·43	10	1·05
Roaring ..	...	...	...	...	.	...		...
Shivering ..	...	..	..	..	..	...	...	...
Nasal Disease	..	...		..	.	...	...	...
Total unsound	89	12·03	19	13·67	2	2·85	110	11·59
Disapproved	59	7 92	14	10·07	25	35·71	98	10·27
Total rejected	148	19.73	33	23·74	27	38·57	208	21·8

Taking the different breeds and comparing with the work done in 1911-12, the number of draught horses rejected was practically the same, though the reasons for such rejections vary, there being an increase of 1 per cent. rejected on account of the hereditary unsoundness, sidebone, which is counterbalanced by the fact that no horses were rejected for bog spavin, roaring, or shivering. Of the

light horses, a total of 23.74 per cent. was rejected, a decrease of 2.92 per cent. in respect of the number the previous season. As regards the reasons for rejection, there was an increase of 5.80 per cent. in respect of unsoundness, and a decrease of 8.7 per cent. in respect of disapproval. Of the unsoundnesses, bone spavin and curb are responsible for the increased number rejected. For ponies, fewer by 1.24 per cent. were found unsound, whilst on account of disapproval, 35.71 per cent. were refused, or an increase of 7.85 per cent.

The foregoing table shows a complete analysis of the season's operations, whilst upon page 261 is found a summary of the six years' work.

RE-EXAMINATION.

Three hundred and twenty horses which had been previously certificated were presented for re-examination. The accompanying table indicates the result of such examination.

HORSES SUBMITTED FOR RENEWAL OF CERTIFICATE, SEASON 1912-13

Four years old.				Five years old.			
Passed.	Rejected.	Per cent.	Total.	Passed.	Rejected.	Per cent.	Total.
144	18	11·11	162	144	14	8·86	158

Total re-exams., 320; total passed, 288; total rejected, 32; percentage rejects, 10.

TRANSFERRED CERTIFICATES.

Of the 82 draught stallions which were introduced from the United Kingdom during the season, 56 presented certificates obtained in England from one or other of the societies mentioned in the regulations, and for which Victorian Government certificates are substituted.

In respect of such English certificates, however, breeders should note that it is a Victorian Government Certificate of Soundness which is required in respect of horses exhibited at shows, and that English certificates only entitle the holder to the issue of a Victorian certificate without submitting the horse for re-examination. It is, therefore, necessary that such English certificates should be presented for transfer at the earliest possible moment. Considerable trouble and frequent disappointment would then be obviated.

On occasion during the season under review some trouble occurred owing to this failure to have the certificate transferred. The same remarks apply to certificates issued in the adjoining States, but no further trouble would occur if stallion owners would realize that until a certificate is duly registered in the office of this Department and a Victorian certificate substituted, it is of no value in respect of exhibition at shows.

Attention should also be drawn once more to the fact that if a certificate is issued in New Zealand prior to 1st April in any year, it can only be transferred for a Victorian certificate expiring on the ensuing 30th June, whilst a certificate issued after that date is exchangeable for a Victorian one terminating on the 30th June, twelve months.

In addition to the number of certificates transferred for English examinations, as above, there were 54 issued in New Zealand, 11 in New South Wales, and 3 in South Australia, for which Victorian transfers were made.

ALTERATIONS TO REGULATIONS.

Experience has once more demonstrated that the regulations can be altered to a slight degree in order to facilitate the operations of the scheme. In Regulation III., clause 2, " Grounds for rejection," the words, " Unless dealt with under the Appeal Board conditions " have been deleted. This will permit an Appeal Board examining in respect of a stallion refused a certificate as regards type and conformation to reject the horse *for the season only,* and so enable the owner to re-submit such animal the following year for examination before a veterinary officer. Regulation II., clause 3, " Certificates," has been amended, and in future certificates will be forwarded direct to the owner, and not, as previously, to the secretaries of the societies under whose auspices the parades are held. Provision will be made for secretaries of societies to be notified which, if any, of the horses submitted at such parade for examination obtain their certificate. Under Regulation V., clause 3, provision has been made for the acceptance of the certificate of the Board of Agriculture of Great Britain to be accepted as a certificate for which a Victorian Government Certificate of Soundness will be issued.

The accompanying table is an analysis of the examinations carried out by the individual officers. It will show that, as in previous years, the bulk of the work has been performed by three officers.

TABLE 4.

OFFICERS' EXAMINATIONS OF STALLIONS. SEASON 1912-13.

Officer.	Number Examined.	Number Certificated.	Number Rejected.	Percentage Rejected.
Mr. E. A. Kendall, B.V.Sc.	393	304	89	22·64
Mr. R. G. Griffin, M.R.C.V.S. .	227	186	41	18·06
Mr. R. N. Johnstone, B.V.Sc. ...	296	226	70	23·65
Mr. G. Heslop, B.V.Sc.	22	16	6	27·27
Mr. W. J. Cother, G.M.V.C.	8	8	..	
Appeal Boards	8	6	2	25·00
Total ...	954	746	208	21·8

" APPEALS."

Since the last report eight appeals have been lodged. Two of these, however, it should be noted, were appeals in respect of stallions examined during the previous season, but in which the appeal was held too late to allow inclusion in the previous report. Of the number, five were appeals against rejection on account of being below reasonable standard in respect of type and conformation. In each case the appellant was successful, and a certificate was issued. In the remaining three appeals, which were in respect of unsoundness, the Board upheld the Veterinary Officer's decision in two cases and reversed the decision, and recommended the issue of a certificate in one.

SUMMARY OF SIX YEARS' WORK, 1907-1913.

Season.	Draughts.					Lights.					Ponies.					Totals.				
	Examined.	Certificated.	Rejected.		Percentage.	Examined.	Certificated.	Rejected.		Percentage.	Examined.	Certificated.	Rejected.		Percentage.	Examined.	Certificated.	Rejected.		Percentage.
1907–8 ..	403	271	Unsound	96	23 82	301	246	Unsound	32	10·63	214	186	Unsound	10	4 67	918	703	Unsound ..	138	15·04
			Disapproved	36	8·93			Disapproved	23	7 64			Disapproved	18	8·41			Disapproved	77	8·38
				132	32·75				55	18·27				28	13·08				215	23·42
1908–9 ..	501	341	Unsound	137	27 33	295	242	Unsound	29	9·83	199	159	Unsound	5	2·5	995	742	Unsound ..	171	17·17
			Disapproved	23	4·59			Disapproved	24	8·13			Disapproved	35	17·58			Disapproved	82	8·24
				160	31·92				53	17·96				40	20·10				253	25·41
1909–10 ..	410	275	Unsound	96	23·52	191	147	Unsound	12	6·27	156	112	Unsound	5	3·29	757	534	Unsound .	113	15·04
			Disapproved	39	9·56			Disapproved	32	16 77			Disapproved	39	25·65			Disapproved	110	14·65
				135	33·08				44	23 04				44	28·94				223	29·69
1910–11 ..	542	387	Unsound	117	21·57	143	108	Unsound	15	10·53	128	101	Unsound	7	5·47	813	596	Unsound ..	139	17·09
			Disapproved	38	7 01			Disapproved	20	14 08			Disapproved	20	15·62			Disapproved	78	9·6
				155	28·58				35	24·61				27	21·09				217	26·69
1911–12 ..	692	554	Unsound	84	12·13	165	120	Unsound	13	7 87	122	83	Unsound	5	4·09	979	758	Unsound ..	102	10·42
			Disapproved	54	7·8			Disapproved	31	18 78			Disapproved	34	27·86			Disapproved	119	12·15
				138	19·94				44	26·66				39	31·96				221	22·57
1912–13 ..	745	597	Unsound	89	12 03	139	106	Unsound	19	13 67	70	43	Unsound	2	2·85	954	746	Unsound ..	110	11·59
			Disapproved	59	7·92			Disapproved	14	10 07			Disapproved	25	35·71			Disapproved	98	10·27
				148	19·73				33	23·74				27	38·57				208	21·81

REGULATIONS

GOVERNING THE EXAMINATION OF STALLIONS FOR THE GOVERNMENT CERTIFICATE OF SOUNDNESS AND APPROVAL.

I.—EXAMINATION PARADES.

(1) Societies within whose district an Inspection Parade is appointed are required to provide a suitable place for the examinations to be conducted, and to suitably and reasonably advertise the holding of the parade on receipt of notice from the Department of the fixture. The secretary or some member of the committee of the society is required to be in attendance at the appointed time to assist the examining officer in the arrangements for the inspection.

(2) The Parades will be conducted and the Veterinary Officer will attend without expense to Societies other than that involved in advertising and making known the occasion to the public and the Stallion owners in the district, and providing the examination ground.

(3) The Examining Officer will attend Inspection Parades held at times and places set out in the official Time Table for the year, and all examinations of Stallions for the Government Certificate will be made at such Parades or on some such publicly advertised occasion, *unless* under special circumstances as provided for in clause 5.

(4) In the event of it being found impossible for local reasons to hold the Parade in any district at the time and date set out in the Time Table, notice to that effect—together with suggestions for alternative date and time compatible with the rest of the Time Table—should be given *not later than 1st June*, after which no alteration in the Time Table can be made.

(5) The special examination of stallions for the Government Certificate of Soundness at other than the advertised stallion parades may be arranged for in cases where, through accidental circumstances, the owner has failed to submit the horse at such parade.

Such examinations will only be arranged when the attendance of the Examining Officer will not interfere with the requirements of the Department for his services in other directions.

An owner requesting such special examinations will be required to prepay a fee of £1 1s. for each horse examined; also the railway fare (first class return), and travelling expenses at the rate of 14s. per day, of the visiting officer.

II.—GROUNDS FOR REJECTION.

(1) Refusal of Certificate on the ground of unsoundnes will be made only when, in the opinion of the Examining Officer, the horse is affected at the time of examination with one or more of the following hereditary unsoundnesses in any degree, viz:—

Roaring	Curb	Thoroughpin and Bursal Enlargements
Ringbone	Bog Spavin	Nasal disease (Osteo-porosis)
Sidebone	Bone Spavin	Chorea ("Shivering" or "Nervy")

or such other hereditary unsoundness as the Minister may at any time declare. (Blemishes or unsoundness, the result—in the opinion of the Examining Officer on appearances then presented—of accident, injury, and over-strain or over-work, will not disqualify.)

(2) The Certificate will also be refused in the case of animals considered by the Examining Officer to be below a reasonable standard for Government approval, as regards type, conformation, and breeding.

(3) Stallions three or four years old, which are refused a Certificate as regards type, conformation, and breeding may be re-submitted annually until five years old, after which the refusal shall be subject to review under Part V. of these regulations only.

III.—CERTIFICATES.

(1) Particulars concerning the identity of the horse—name, breeder, pedigree, age, prior ownership, &c.—must be furnished to the Examining Officer at the time of examination. If deemed necessary in any case the owner may be called upon to furnish a statutory declaration as to the correctness of such particulars.

(2) Certificates will be issued within seven days of the holding of the Parades, and will be forwarded to the owner direct. Secretaries of Societies under whose auspices the Parade is held will be notified which, if any, of the horses submitted for examination obtain their Certificates.

(3) The owners of stallions for which a Certificate is refused will within seven days of such refusal be officially notified of the fact; the reason for such rejection will also be given.

(4) Until the issue of a Certificate, or until the publication of the official list of certificated stallions, the result of the Veterinary examination will not be communicated to any person except as herein provided or under circumstances as follow:—The Examining Officer may, on request on proper occasion, communicate to the owner or his agent—duly authorized in writing to inquire—the result of the examination. In case of refusal of the Certificate the reasons for refusal will not under any circumstances, save in legal proceedings under the direction of the Court, be communicated to any person except the owner or his agent duly authorized in writing. Secretaries of Societies, persons in charge of the horse, grooms or relatives of the owner will not be considered authorized agents for that purpose unless they deliver to the officer the owner's signed authority to receive the information.

(5) The Victorian Government Certificate of Soundness can only be issued in respect of horses three years old and over, that have been examined by a Victorian Government Veterinary Officer, or horses in respect of which any of the following certificates are produced:—

The Government Certificate of Soundness of New South Wales, Queensland, South Australia, or New Zealand.

The Veterinary Certificate of the Royal Shire Horse Society (England).

The Veterinary Certificate of Royal Agricultural Society (England).

The Veterinary Certificate of Royal Dublin Society (Ireland).

The Veterinary Certificate of Highland and Agricultural Society (Scotland).

The Veterinary Certificate of Glasgow and West of Scotland Agricultural Society.

The Veterinary Certificate of the Board of Agriculture and Fisheries (England).

Any horse which has been rejected by the Veterinary Examiners for any of the above certificates will not be eligible for examination for the Victorian Government Certificate of Soundness.

(6) The form of the Victorian Government Certificate of Soundness is as follows:—"G.R.—Department of Agriculture, Victoria, No. . Certificate of Soundness and Approval, issued for the season (*or issued for Life as the case may be*), given in respect of the (*breed*) stallion (*name and description of stallion*) submitted for Government inspection by the owner (*name of owner*) at (*place of examination*) such horse having been found suitable for stud service and free from hereditary unsoundness and defects of conformation predisposing thereto on examination by (*signature of Examining Officer*) Veterinary Officer on the day of 19 .

(Signature).

Chief Veterinary Officer.

Issued by direction of the Minister of Agriculture.

(Signature).

Secretary for Agriculture."

(7) Two-year-old colts may be submitted for examination and a temporary certificate will be issued in respect of such as pass the examination. Such temporary certificate must not be taken to imply suitability for stud service of approval as regards type, nor is the issue of it intended as an indication of the likelihood of a certificate being issued when submitted for examination at a more mature age.

(8) The season in respect of Government Certificates shall be considered as opening on 1st July, stallions passing the examination any time during the three months previous to this date in New Zealand or Australia will be granted a Certificate for the season next following. In respect of stallions examined in Great Britain examinations on or after 1st January will be considered as examinations for the following season.

IV.—TENURE OF CERTIFICATE.

(1) Certificates issued during the season 1907 and 1908 are life certificates.

(2) Certificates issued during the season 1908 in respect of horses four years old and over are life certificates; those for three-year-olds are season certificates only, and the horse must be submitted for re-examination at four and five years before a life certificate will be issued.

(3) In 1910, and subsequently, only stallions *five* years old and over will be given life certificates. *Three-year-old* and *four-year-old*

stallions will be certificated for the *season only,* and will be required to be submitted for *re*-examination each season *until five* years old, when a Life certificate will be issued.

(4) The Season certificate issued in respect of any horse must be handed to the Examining Officer at the time of re-examination or forwarded to the Chief Veterinary Officer before a subsequent Season certificate or a Life certificate will be issued.

(5) The Minister retains the right to at any time have a certificated stallion submitted for re-examination, and to withdraw the certificate, in the event of the animal being declared, to his satisfaction, unsound.

V.—BOARD OF APPEAL.

(1) Any owner of a stallion who is dissatisfied with the refusal of a Government certificate in respect of his horse may appeal against the decision to the Minister at any time within *thirty* days of the examination, under the following conditions:—

(*a*) That the appeal be in writing and be accompanied by the lodgment of £5, such amount to be forfeited in the event of the appeal *not* being upheld, unless the Board shall for good cause otherwise direct.

(*b*) That the appeal be accompanied by an undertaking to pay any railway fares and hotel expenses incurred by the Board of Appeal in connexion with the settlement of the appeal.

(*c*) That, in the event of refusal having been on the ground of unsoundness, the appeal be accompanied by a certificate from a registered Veterinary Surgeon setting out that the horse has been found by him on examination since the refusal appealed against, to be free from all the unsoundnesses set out in Part II. of these regulations.

(*d*) That, in the event of refusal having been on the ground of being below standard for Government approval, the appeal be accompanied by a certificate from the President and two members of the Committee of the Society under whose auspices the parade was held, setting out that in their opinion the horse is of fit and proper type, conformation, and breeding to be approved as a stud horse.

(2) On receipt of Notice of Appeal in proper form, and with the above conditions complied with, the Minister will appoint a Board of Appeal, which shall consist of:—

(*a*) In the case of appeals against refusal of certificate on the ground of unsoundness, the Chief Veterinary Officer and two practising Veterinary Surgeons.

(*b*) In the case of appeals against refusal of certificate as being below standard for Government approval, the Chief Veterinary Officer and two horsemen of repute and standing.

Such Board shall act and decide on the appeal, and its decision shall be final, and *not subject to review.*

(3) In the event of the appeal being allowed, refund shall be made of the deposit, and any expenses paid by the appellant under Clause 1 (*b*). Further, the Board may recommend to the Minister the allowance of such of the expenses of the appellant in supporting his appeal as it may consider reasonable under the circumstances of the case, and the Minister may, in his discretion, confirm the recommendation in whole or in part, whereupon allowance shall be made to the appellant accordingly.

(4) No stallion in respect of which a Government certificate is refused will be allowed to be re-submitted for examination except in the case of an appeal or in such case as when a three or four years old stallion has been refused on account of type as herein provided for. In the event of any rejected stallion being re-submitted for examination under another name or under such circumstances as in the opinion of the Minister are calculated to mislead the Examining Officer into the belief that the horse has not previously been examined, the owner of such rejected stallion, if proved to the satisfaction of the Minister that he is responsible for such re-submission, shall be debarred from submitting any horse for examination for such period as the Minister shall determine.

NOTICE TO SECRETARIES OF AGRICULTURAL SOCIETIES.

Section " A " of the conditions to be complied with by Agricultural Societies before being eligible for participation in the annual Government grant is as follows:—

> " *A.—That the awards of prizes in all classes for stallions, three years old and over, at the Society's Show must be subject to the possession by the exhibit of a Government certificate of soundness.*"

In order to comply with the above, the special attention of show secretaries is invited to the receiving of entries in stallion classes. No entry should be received unless at the time of entry the Government certificate is produced, or unless satisfactory evidence is given that a Government certificate is held by the owner in respect of the exhibit. The awarding of a prize card and the withholding of prize money in respect of any exhibit shall not be deemed as compliance with the condition. Care should be taken also to see that the certificate is not out of date, that is to say:—

For three-year-olds a 1913 three-year-old certificate must be held.
For four-year-olds, a 1913 four-year-old certificate must be held (the 1912 certificates are out of date).
For horses five years old and over, a life certificate must be held.

Particular attention is directed to the method now in vogue of classifying certificated stallions. The list is now divided into horses carrying a life certificate and those which are terminable, and supplementary lists will be issued annually which should be added to those listed in Bulletin No. 30 and No. 17 (New Series).

Secretaries are strongly urged to become familiar with the regulations, particularly Regulation IV., which deals with the tenure of certificates.

Secretaries are required to forward immediately after the show a return (forms for which will be sent to each society) giving required particulars concerning 1st, 2nd, and 3rd prize winners as under:—

RETURN to be forwarded to the Chief Veterinary Officer concerning Stallions (three years old and over) awarded Prizes at the .... Agricultural Society's Show held ....

Name of Stallion.	Certificate Number.	Name of Class and Section (not Number).	Prize Awarded.			Owner's Name.	Owner's Address.
			1st.	2nd.	3rd.		

(Signed) ....

Secretary .... Agricultural Society.

Date ....

STALLION EXAMINATION.

SUPPLEMENTARY LIST OF LIFE CERTIFICATED STALLIONS.

Cert. No.	Name of Horse.	Age.	Owner.	Parade.	Date of Examination.	Officer.
			DRAUGHTS.			
2192	Abbotsford	5 years	A. Cameron	Newmarket	22.7.12	R.G.
2193	Abbotsford's Pride	5 years	H. J. Kortum	Newmarket	22.7.12	R.N.J.
2328	Admiral Sperry	5 years	H. S. Gibson	Traralgon	11.9.12	R.G.
2256	Agate	5 years	J. Caffrey	Dimboola	16.8.12	E.A.K.
2338	Aitken Chief	5 years	E. Cuthbert	Camperdown	11.9.12	E.A.K.
2212	Arawa	6 years	Jas. Hamilton	Bendigo Special	1.8.12	R.G.
2155	Archives	5 years	J. O'Keefe	English Exam.	15.2.12	..
2150	Auchencruive	5 years	J. R. McKenzie	Scottish Exam.	30.12.11	..
2266	Balmoral	Aged	A. Henman	Rainbow	6.8.12	R G.
2162	Balnakill	5 years	Robertson and McKenzie	Newmarket (Special Exam.)	6.5.12	E.A.K.
2156	Bardon Masterpiece	5 years	F. W. Griffin	English Exam.	29.2.12	.
2180	Bardon Napoleon	5 years	W. Price-Jones	Newmarket (Special Exam.)	28.6.12	E A.K.
2306	Baron	5 years	Craven Bros.	Shepparton	23.8.12	E.A.K.
2274	Baron Bombay	5 years	Shields Bros.	Dookie	19.8.12	R.N.J.
2379	Baron Bute	5 years	G. Chirnside	Werribee (Special)	6.3.13	R.G.
2168	Baron Craigie	5 years	Mitchell and O'Brien	City Horse Bazaar	18.6.12	R.G.
2267	Baron Irvine	5 years	C. H. Perkins	Rainbow	6.8.12	R.G.
2331	Baron McLeod	5 years	R. Kerr	Lillydale	13.9.12	R G.
2185	Baron McNair	5 years	A. E. Bowman	City Horse Bazaar	15.7.12	R.N.J.
2324	Baron's Best	5 years	J. Glenn	Royal Show	3.9 12	E.A.K.
2366	Baron's Chief	5 years	H. McNab	Morwell	1.10.12	R.N.J.
2175	Baron's Pride	5 years	John Petrie, jun.	Horsham	3.7.12	R.N.J.
2203	Barossa II.	5 years	J. Gilmour	Sea Lake	17.7.12	G H
2166	Biddulph Bondsman	5 years	G. Smith	Newmarket (Special)	17.6.12	E.A.K.
2263	Blue Bell	5 years	H. Collins	Minyip	9.8.12	R.G.
2268	Bonnie Ben	6 years	C. J. Liesfield	Rainbow	6.8.12	R.G.
2287	Bonnie Scott	5 years	Miss Henty	Casterton	21.8.12	R.G.
2171	Bramhope Forester	Aged	A. and J. H Young	Horsham	2.7.12	R.N.J.
2151	Branton Goldsmith	5 years	J. R. McKenzie	Scottish Exam.	3.1.12	..
2152	British Consul	5 years	J. Weir	Scottish Exam.	3.1.12	..
2336	British Leader	5 years	W. Underwood	Colac	13.9.12	E.A.K.
2377	Brydon	5 years	Jas. Lawson	Binginwarri (Special Exam.)	5.12 12	R.N.J.
2254	Cairnbrogie Stamp	5 years	Joseph Binns	Nhill	14.8.12	E.A.K.
2246	Casabianca	Aged	H. Galloway	Maryborough	12.8.12	R.N.J.
2161	Casabianca Again	5 years	J. R. McKenzie	Scottish Exam.	29.6.11	..
2343	Channel Flight	5 years	P. Fraser	Ballarat	14.9 12	R.N.J.
2238	Charmer Junior	5 years	MacKenzie Bros.	Rainbow	7.8.12	G.H.
2278	Clumber Baronet	5 years	Bedwell and Cobbledick	Numurkah	23.8.12	R.N.J.
2240	Clyde Boy	5 years	Walder and Sons	Watchem	8.8.12	R.N.J.
2323	Crown Derby	5 years	W. S. Graham	Echuca	21.8.12	E.A.K.
2356	Crown Prince	5 years	A. Simon	Tallangatta	23.9.12	R.N.J.
2294	Cumloden	5 years	J. Crawford	Rochester	20.8.12	E.A.K.
2352	Dainty Davie	5 years	J. Low	Korumburra	18.9.12	R G.
2243	Dalmuir Prince II.	5 years	J. Carroll, jun.	Birchip	9.8.12	R.N.J.
2194	Dominion Chief	5 years	M. Rocks	Newmarket	22.7.12	R.G.
2279	Dreadnought	5 years	F. Metherall	Numurkah	23.8.12	R.N.J.
2167	Dreadnought	5 years	M. J. Caffrey	Newmarket (Special)	17.6.12	E.A.K.
2302	Drum Laddie	5 years	C. R. Roper	Kyabram	22.8.12	E.A.K.
2316	Drummer	5 years	Anderson Bros.	Royal Show	2.9.12	R.G.
2368	Dundonald	6 years	Gibson Bros.	Omeo	9.10.12	E.A.K.
2255	Earl of Newton	5 years	Blythman Bros.	Nhill	14.8.12	E.A.K.
2284	Enfield	5 years	A. S. Brewis	Hamilton	22.8.12	R.G.
2225	Federal Laddie	5 years	J. Kurtzmann	Stawell	5.8.12	R.G.
..	Federal Prince	..	McDougall Bros.	New South Wales	12.7.12	..
2261	Federal Star	5 years	Colin Gardner	Wangaratta	13.8.12	R.G.
2372	Fine View	5 years	H. C. Hateley	Murtoa (Special)	24.10.12	E.A.K.
2303	Finstall Forest Victor	5 years	J. Archibald	Kyabram	22.8.12	E.A.K.
2358	Flash Newton	5 years	R. Watson	Diggers' Rest (Special)	24.9.12	E.A.K.
2258	Gay Lad	5 years	Phillips Bros.	Geelong	13.8.12	E.A.K.
2218	Glenalbyn	5 years	W. and P. Salmon	Beulah	1.8.12	E.A.K.
2298	Glengarry	5 years	A. J. Donaldson	Tatura	22.8.12	E.A.K.
2153	Good Gam?	5 years	W. French	Scottish Exam.	3.1.12	..
2310	Hawton Burly	5 years	T. McMillan	Mildura	27.8.12	R.N.J.

SUPPLEMENTARY LIST OF LIFE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Age.	Owner.	Parade.	Date of Examination.	Officer.
			DRAUGHTS—*continued.*			
2208	Highland Boy	5 years	S. Cameron	Quambatook	30.7.12	R.G.
2330	Joe Horner	5 years	Murphy Bros.	Sale	12.9.12	R.G.
2378	Knight Dunmore	5 years	D. J. Kelleher	Kilmore (Special)	4.2.12	R.G.
2221	Knottingley President	5 years	Schmidt Bros.	Warracknabeal	2.8.12	E.A.K.
2196	King Jimmy	5 years	C. N. Byriell	Newmarket	22.7.12	E.A.K.
2269	King of the Shepherds	5 years	W. Gould	Rainbow	6.8.12	R.G.
2164	King of the Times	5 years	Hoy Ling	New Zealand Exam.	14.2.11	..
2375	Linkwood	5 years	R. Cairns	Charlton	14 11.12	Appeal Board
2233	Loch Albyn	5 years	T. Brown	Elmore	9.8.12	E A.K.
2265	Loch Lomond	5 years	F. W. Stephen	Dimboola	16.8.12	E.A.K.
2206	Lolworth Premier II.	5 years	M. J. Caffrey	Agricultural Offices	27.7.12	R.G.
2355	Lord Galloway	5 years	R. G. Kiell	Corryong	18.9.12	R N.J.
2319	Lord Glencairn	5 years	R. Gilby	Royal Show	2.9.12	R G.
2250	Lord Haldon	5 years	N. Ramsay	Inglewood	13.8.12	R.N.J.
2300	Lord Islington	5 years	J. Wilson	Tatura	22.8.12	E.A.K.
2197	Lord Lieston	5 years	H. Doidge	Newmarket	22.7.12	E.A.K
2198	Lord Lindsay	5 years	D. Lang	Newmarket	22.7.12	R.N.J.
2239	Lord of the Isles	6 years	W. D. Wallis	Jeparit	7.8.12	R.G.
..	Lord Trentham	5 years	T. Kennedy	New Zealand Exam	9.3.12	.
2275	Lorryman	5 years	W. Grattan	Dookie	19.8.12	R.N.J.
2307	Major	5 years	E. Walker	Shepparton	23.8.12	E A.K.
2297	Major Style	5 years	C. Hall	Echuca	21.8.12	E.A.K.
2247	Melbourne Prince	5 years	H. Galloway	Maryborough	12.8.12	R.N.J.
2380	Monestral Royal Harold	Aged	M. J. Caffrey	New Zealand Exam	21.1.13	..
2205	Middlemarch	5 years	J. and M. Egan	Charlton	18.7.12	G.H.
2313	Milton's Pride	5 years	P Downes	Yarrawonga	27.8 12	E.A.K.
2228	Moira Lad	5 years	J. W. Barton	Swan Hill	7.8.12	E.A.K.
2214	Montgomery	5 years	C. B. McFarlane	Hopetoun	30.7.12	E.A.K.
2270	Mountain Chief	5 years	C. J. Liesfield	Rainbow	6.8 12	R.G.
2369	Musket	Aged	J Braid	Omeo	9.10 12	E.A K.
2226	Napoleon	5 years	C Marfleet	Pyramid	6.8.12	E.A.K.
2370	Napol on Bonaparte	Aged	A. W. Souter	Omeo	9.10 12	E.A.K.
2281	Newton's Sensation	5 years	J. Meiklejohn	Numurkah	23.8.12	R.N.J.
2176	Oakburn	5 years	A. C. Petrass	Horsham	3.7.12	E.A.K.
2292	Oliver Twist	5 years	Ingram Bros.	Rochester	20 8.12	E.A.K.
2363	Patrick's Pride	5 years	E. L. Edwards	Kilmore	26.9.12	R.G.
2253	Percy's Hero	5 years	J. Vennell	Kaniva	15.8.12	E.A.K.
2231	Powisland Blue Blood II.	5 years	D. J. Milne	Kerang	9.8.12	E.A.K.
2311	Primley Achilles	5 years	R. A. Smales	Mildura	27.8.12	R.N.J.
2163	Procurator	5 years	C. Parsons	Newmarket (Special)	6.5.12	E A.K.
2148	Prince Aerial	5 years	O'Leary Bros.	Penshurst	22 2.12	Appeal Board
2301	Prince Ettrick	5 years	A. McNamara	Tatura	22.8.12	E.A.K.
2308	Prince Newton	5 years	W. G. Down	Shepparton	23 8 12	E.A.K.
2273	Prince of Elderslie	5 years	W. J. Baikie	Cobram	23.8 12	R.N.J.
2227	Red Ensign	5 years	J. Ervin, sen.	Pyramid	6.8.12	E.A.K.
2271	Royal Charlie	5 years	W. J. Black	Benalla	15.8.12	R.G.
2340	Royal Colours	Aged	J. Ball	Werribee	14.9.12	E.A.K.
2339	Royal Fashion	5 years	E. Cuthbert	Camperdown	11.9.12	E.A.K.
2283	Royal Favourite	5 years	H. J. Graham	Numurkah	23.8.12	R.N.J.
2229	Royal Gift	5 years	W. McKnight	Swan Hill	7.8.12	E.A.K.
2188	Royal Park	5 years	T. Oliver	City Horse Bazaar	15.7.12	R.G.
2209	Royal Scot	6 years	R. Fleming	Quambatook	30.7.12	R.G
2189	Salisbury Hero	5 years	A. and J. Rankin	City Horse Bazaar	15.7.12	R.G.
2291	Scotch Heather	Aged	P. Fry	Hamilton	22.8.12	R.G.
2351	Searchlight	5 years	W. J. Craig	Korumburra	18.9.12	R.G.
2350	Searchlight	5 year.	W. W. Herbert	Warragul	18.9.12	E.A.K.
2199	St. Andrew	6 years	A. Hart	Newmarket	22.7.12	E.A.K.
2347	Stirling Castle	5 years	R. V. Colliver	Lang Lang	17.9.12	R.G.
2200	Sweet William	5 years	Caffrey and Murphy	Newmarket	22.7.12	R.N.J.
2177	Sir Isaac Newton	6 years	D. McDonald and Sons	Horsham	3.7.12	E.A.K.
2360	Sir Malcolm	5 years	A. Wohlers	Ballan	26.9.12	E.A.K.
2257	Sir Patrick	5 years	H. Hill	Dimboola	16.8.12	E.A.K.
2359	Sir Percival II.	Aged	W. E. Hayes	Leongatha	16.9.12	R.G.
2312	Tam McKenzie	5 years	V. C. Reid	Agricultural Offices	31.8.12	R.N.J.
2210	Tam O' Again	5 years	C. Hands	Boort	30.7.12	R G.
2371	Target	7 years	Gibson Bros.	Omeo	9.10.12	E.A.K.

Supplementary List of Life Certificated Stallions—*continued.*

Cert. No.	Name of Horse.	Age.	Owner.	Parade.	Date of Examination.	Officer.
			Draughts—*continued.*			
2170	Tom Walton ..	5 years	F. W. Sallmann ..	Dimboola (Special)	2.7.12	E.A.K.
2191	The Colonel ..	5 years	S. Dunn ..	City Horse Bazaar	19.7.12	R.G.
2222	The Workman ..	6 years	A. Arnold ..	Warracknabeal ..	2.8.12	E.A.K.
2374	Udale	5 years	H. A. Currie ..	Camperdown (Special)	28.11.12	E.A.K.
2248	Uxbridge Fyvie ..	5 years	J. McCulloch ..	Maryborough ..	12.8.12	R.N.J.
2154	Wabun	5 years	E. Currie ..	Scottish Exam. ..	3.1.12	..
2179	Waikato	5 years	G. H. Hill ..	Horsham ..	3.7.12	R.N.J.
2216	Wally	5 years	W. E. Poulton ..	Hopetoun ..	30.7.12	E.A.K.
2217	Young Benmore ..	Aged	C. G. Lear ..	Hopetoun ..	30.7.12	E.A.K.
2285	Young Coronation ..	Aged	J. W. Mibus ..	Hamilton ..	22.8.12	R.G.
2264	Young St. Albans ..	5 years	G. R. Goods ..	Minyip	8.8.12	R.G.
			THOROUGHBREDS.			
2186	Clyde	Aged	F. W. Clarke ..	City Horse Bazaar	15.7.12	R.N.J.
2159	Demolition ..	Aged	O. Maroske ..	Agricultural Offices	24.4.12	E.A.K.
2195	Euclid	Aged	J. R. Henry ..	Newmarket ..	22.7.12	R.N.J.
..	Ganymedes ..	Aged	T. O. Guthrie ..	South Australian Exam.	1.8.12	..
2260	Harmattan ..	5 years	R. W. Storey ..	Euroa	16.8.12	R.G.
2289	Lord Nolan ..	Aged	Dr. Syme ..	Mordialloc (Special)	27.8.12	W.J.C.
2320	Orissa	6 years	C. J. H. Nissen ..	Royal Show ..	2.9.12	E.A.K.
2147	Posture	Aged	J. D. Lewis ..	Agricultural Offices	2.3.12	R.N.J.
2215	Royal Fusilier ..	Aged	Turner Bros. ..	New Zealand Exam.	29.6.12	..
2362	Salvador	Aged	S. R. Lawrence ..	Swan Hill (Special)	25.9.12	R.N.J.
2309	Sentronus ..	6 years	S. Whitehead ..	Shepparton ..	23.8.12	E.A.K.
2172	Stickup	Aged	A. and J. H. Young	Horsham ..	2.7.12	R.N.J.
..	St. Vincent ..	Aged	H. Mentha ..	Sth. Aust. Exam.	22.9.09	..
			LIGHT HORSES.			
2219	Almont S... ..	5 years	F. W. Schickerling	Warracknabeal ..	2.8.12	E.A.K.
2237	Arrel	5 years	J. Dempster ..	Heathcote ..	5.8.12	R.N.J.
2305	Ashville Boy ..	5 years	T. Moore ..	Shepparton ..	23.8.12	E.A.K.
2241	Bolac	Aged	R. McMaster ..	Ararat	9.8.12	R.G.
2342	Booberoo	Aged	G. N. Horne ..	Ballarat ..	14.9.12	R.N.J.
..	Cocomar	5 years	P. Quirk ..	N.S.W. Exam. ..	16.5.12	..
2232	Correct Way ..	Aged	J. O'Donnell ..	Elmore	9.8.12	E.A.K.
2249	Decorator ..	5 years	F. Jennings ..	Inglewood ..	13.8.12	R.N.J.
2272	Digilista	Aged	J. Reynoldson ..	Cobram ..	23.8.12	R.N.J.
2295	Digitalto	5 years	J. W. Smith ..	Rochester ..	20.8.12	E.A.K.
2314	Dignity	5 years	W. Lang ..	Royal Show ..	2.9.12	E.A.K.
2315	Dillon Bell ..	5 years	W. Edwards ..	Royal Show ..	2.9.12	R.N.J.
2349	Dixie Claire ..	6 years	D. A. Linacre ..	Warragul ..	18.9.12	E.A.K.
2213	Donald Wallace ..	5 years	J. M. Oughtred ..	Wycheproof ..	2.8.12	W.J.C.
2207	Expectation ..	Aged	S. Cameron ..	Quambatook ..	30.7.12	R.G.
2187	Financier	Aged	W. L. Tredrea ..	City Horse Bazaar	15.7.12	R.N.J.
2173	Gerald Cleve ..	5 years	P. Seclander ..	Warracknabeal ..	2.7.12	R.N.J.
2184	Glenroy	Aged	W. A. McLellan ..	City Horse Bazaar	15.7.12	E.A.K.
2174	Grattan Bells ..	6 years	T. Sherwood ..	Dooen North ..	2.7.12	R.N.J.
2262	Huon Junior ..	Aged	P. Maroney ..	Wangaratta ..	13.8.12	R.G.
2353	Jack Huon ..	5 years	P. Donovan ..	Ballarat ..	14.9.12	R.N.J.
2230	Joy Bells ..	5 years	M. Peacock ..	Kerang	9.8.12	E.A.K.
2299	Kent Cleve ..	5 years	J. Devlin ..	Tatura	22.8.12	E.A.K.
2318	King Osterley ..	5 years	D. Taylor ..	Royal Show ..	2.9.12	E.A.K.
2259	King Osterley II. ..	5 years	G. Anderson ..	Geelong ..	13.8.12	E.A.K.
2334	Kingspring ..	5 years	R. McDonald ..	Kyneton ..	10.9.12	R.N.J.
2165	Lou Double ..	Aged	J. J. Bartlett ..	Agricultural Offices	8.6.12	R.G.
2326	Lord McKinney ..	5 years	G. H. Dunlevey ..	Kaneira (Special)	30.8.12	G.H.
2280	Middy Huon ..	5 years	C. Baurchier ..	Numurkah ..	23.8.12	R.N.J.
2245	Millionaire ..	5 years	J. Rossiter ..	Birchip	9.8.12	R.N.J.
2373	Oakwood	5 years	J. F. Folland ..	Ballarat Show (Special)	14.11.12	E.A.K.
2346	O.K.	5 years	G. H. Minns ..	Bacchus Marsh ..	14.9.12	R.G.
2327	Orderly Wilks ..	6 years	W. E. Gibson ..	Mirboo North ..	10.9.12	R.G.
2335	Owyhee Chief ..	5 years	V. Duggan ..	Kyneton ..	10.9.12	R.N.J.
2224	Prince Douglas ..	5 years	Mrs. C. White ..	Agricultural Offices	8.8.12	W.J.C.
2367	Prince Rupert ..	5 years	A. McInnes ..	Morwell ..	1.10.12	R.N.J.
2266	Richard Cleve ..	6 years	H. Doig ..	Agricultural Offices	24.8.12	R.N.J.

SUPPLEMENTARY LIST OF LIFE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Age.	Owner.	Parade.	Date of Examination.	Officer.
			LIGHT HORSES—*continued.*			
2344	Righto	6 years	Sharp Bros.	Ballarat	14.9.12	R.N.J.
2282	Sir Hampden	5 years	J. H. Fraser	Numurkah	23.8.12	R.N.J.
2333	Snip	5 years	A. C. Cook	Dandenong	11.9.12	R.N.J.
2304	Sports Huon	5 years	J. T. Ovens	Kyabram	22.8.12	E.A.K.
2178	Surety	Aged	J. McDonald	Horsham	3.7.12	E.A.K.
2234	The Howlet	5 years	A. Scott	Elmore	9.8.12	E.A.K.
2201	The Jew	Aged	D. Clarke	New Zealand Exam.	14.6.12	..
2325	The Starling	Aged	J. H. Roberts	South Melbourne (Special)	7.9.12	R.G.
2211	Vernon McKinney	5 years	M. Mulligan	Bendigo	31.7.12	R.G.
2357	Weeho	5 years	J. Park	Tallangatta	17.9.12	R.N.J.
2235	Whitty Alto	5 years	S. A. McNaught	Elmore	9.8.12	E.A.K.
2223	Young Almont B.	5 years	J. Mitchell	Warracknabeal	2.8.12	E.A.K.
			PONIES.			
2160	Abitos Girl	5 years	W. E. Glendinning	Agricultural Offices	16.4.12	Appeal Board
2277	Arab Chief	Aged	J. Williams	Numurkah	23.8.12	R.N.J.
.	Bally Leigh	.	A. E. Bowman	N.S.W. Exam.	27.7.10	..
2202	Billie Barlow	5 years	W. M. Donaldson	Charlton	18.7.12	G.H.
2251	Bonnie Argyle	5 years	W. Connors	Myrtleford	14.8.12	R.G.
2293	Brecknock	5 years	W. Tompkinson	Rochester	20.8.12	E.A.K.
2276	Clarion	6 years	W. Thompson	Nathalia	20.8.12	R.N.J.
2252	Dandy	Aged	J. S. Ferguson	Swan Hill	7.8.12	E.A.K.
2361	Dandy Donald	Aged	W. J. Rockett	Swan Hill (Special)	25.9.12	R.N.J.
2332	Dandy O'More	5 years	L. Tatterson	Dandenong	11.9.12	R.N.J.
2286	Garnet	Aged	S. Hutton	Penshurst	23.8.12	R.G.
2290	General Gordon	5 years	H. Dunn	Geelong Parade	13.8.12	E.A.K.
2341	Highland Boy	Aged	P. G. Duffus	Warrnambool	12.9.12	E.A.K.
2220	King George	5 years	C. Wilson	Warracknabeal	2.8.12	E.A.K.
2317	King Leo II.	6 years	E. Stokes	Royal Show	2.9.12	E.A.K.
2244	Little Billy	6 years	J. Lynch	Birchip	9.8.12	R.N.J.
2204	Panic II.	Aged	M. Finn.	Sea Lake	17.7.12	G.H.
2321	Perfection	5 years	R. Wattie	Royal Show	2.9.12	W.J.C.
2296	Reality Rex	5 years	S. O'Brien	Rochester	20.8.12	E.A.K.
2322	Rysharold Hambletonion	5 years	W. B. Metherall and Son	Royal Show	2.9.12	R.N.J.
2376	Satite	5 years	A. J. Plum	Wangaratta (Special)	22.11.12	Appeal Board
2345	Souter Billy	5 years	A. Roberts	Ballarat	14.9.12	R.N.J.
2365	Starlight	..	F. E. Harris	N.S.W. Exam.	2.8.12	.
2364	Starlight	Aged	H. Le Guier	Kilmore	26.9.12	R.G.
..	Sultan	..	Holstock Bros.	N.S.W. Exam.	..	..
2242	The Hero	5 years	V. Hay	Ararat	9.8.12	R.G.
2181	The Ideal	5 years	W. E. Rosling	N.S.W. Exam.	1.4.12	..
2182	The Real Thing	5 years	D. E. Stirrat	N.S.W. Exam.	1.4.12	..
2236	Tommy Dodd	Aged	W. A. Nicholls	Stawell	5.8.12	R.G.
2169	Tom Thumb	5 years	W. H. Thomas	City Horse Bazaar	18.6.12	E.A.K.

LIST OF TERMINABLE CERTIFICATED STALLIONS.

(Four-year-old Certificates expiring 30th June, 1913).

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
			DRAUGHTS.		
574/4	Abbotsford ..	Colvin Bros. ..	Nathalia ..	20.8.12	R.N.J.
447/4	Abbot's Fancy ..	A. Robertson ..	Newmarket (Special)	6.5.12	E.A.K.
492/4	Abbot Smith ..	J. E. Small ..	City Horse Bazaar	15.7 12	R.N.J.
508/4	Abbot's Pride ..	S. H. Wilson ..	Tungamah ..	22.7.12	R.N.J.
567/4	Admiral's Champion	Henry Cronk ..	Wangaratta ..	13.8.12	R G.
575/4	Albion	Oakes Bros. ..	Nathalia ..	20.8.12	R.N.J.
597/4	Attractions Champion	W. Morley ..	Rutherglen ..	26.8.12	E.A.K.
459/4	Auditor	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
618/4	Australia's Favourite	M. Mahoney	Terang	9.9.12	E.A.K.
532/4	Baden Powell ..	J. Adams ..	Swan Hill ..	7.8.12	E.A.K.
505/4	Balfour's Pride ..	J Anderson ..	City Horse Bazaar	16 7.12	R.N.J.
593/4	Balmoral	Green and Son ..	Shepparton ..	23 8.12	E.A.K.
488/4	Bardon Powerful ..	W. Price-Jones ..	English Exam. ..	16 2 12	..
546/4	Baron Argyle ..	W. Hogarty ..	Donald	7.8.12	R.N.J.
493/4	Baron Eiffelton ..	A. Davidson ..	City Horse Bazaar	15.7.12	E.A.K.
455/4	Baronet	Caffrey and Murphy	Newmarket (Special)	17 6.12	E.A.K.
521/4	Baron Fenwick ..	J. H. Sargood ..	Bendigo ..	31.7.12	R.G.
644/4	Baron Gleniffer ..	S. J. Lynn ..	Orbost	3 10.12	R.N.J.
460/4	Baron's Pride ..	T. Kennedy ..	City Horse Bazaar	18.6.12	R.G.
612/4	Baron's Prince ..	Ingram Bros. ..	Kyneton ..	10.9.12	R.N.J.
578/4	Baron Woodlea ..	W. Williams ..	Numurkah ..	23.8.12	R.N.J.
428/4	Barony	J. R. McKenzie ..	Scottish Exam. ..	3.1.12	.
619/4	Barrabool ..	J. Axford ..	Terang	9.9.12	E.A.K.
542/4	Bay Star	T. E. Parry ..	St. Arnaud ..	6.8.12	R.N.J.
516/4	Belted Ben ..	A. Giddings ..	Sea Lake ..	17.7.12	G.H.
429/4	Bladnock	L. H. Lanyon ..	Scottish Exam. ..	3.1.12	..
582/4	Blue Royal ..	Balkin and Gerdts	Hamilton ..	22.8 12	R.G.
522/4	Bold Baron ..	H. Jackman ..	Bendigo ..	31.7.12	R G.
585/4	Bonny Athol ..	W. H. Bidmore ..	Penshurst ..	25.8.12	R.G.
494/4	Border Lad ..	Foster and Son ..	City Horse Bazaar	15.7.12	E.A.K.
633/4	Boro Albert Victor	R. N. Scott ..	Korumburra ..	18 9.12	R.G.
453/4	Boro Baron ..	A. Hart.. ..	Victoria Horse Bazaar (Special)	9.5.12	R.G.
444/4	Boro Menestral III.	E. Parkes ..	English Exam. ..	15.2.13	..
438/4	Bramhope Parthian	R. W. Renfrey ..	English Exam. ..	15.2.12	..
517/4	Braw Scot ..	Alex. Sands ..	Sea Lake ..	17.7.12	G.H.
487/4	Breedon Pioneer ..	A. and J. H. Young	Horsham ..	2.7.12	R.N.J.
456/4	Bridge Hill King ..	M. J. Caffrey ..	Newmarket (Special)	17.6.12	E.A.K.
509/4	British Heather ..	S. H. Wilson ..	Newmarket ..	22.7.12	E.A.K.
510/4	Brown Friar ..	—. Mcminsen ..	Newmarket ..	22.7.12	E.A.K.
572/4	Captain Dale ..	E. Roberts ..	Charlton ..	22.8.12	W.J.C.
599/4	Captain Grigg ..	J. Blackwood ..	Yarrawonga ..	27.8.12	E.A.K.
442/4	Carmichael ..	Gooden Bros. ..	Illowa (Special) ..	16.4.12	E.A.K.
600/4	Carolyn	J. W. Dean ..	Royal Show ..	2.9.12	R.G.
486/4	Cast Iron II. ..	A. and J. Young..	Horsham ..	2.7.12	R.N.J.
528/4	Champion Again ..	Lee and Sons ..	Goroke	31.7.12	G.H.
495/4	Champion of the West	W. Zimmerman ..	City Horse Bazaar	15.7.12	R.G.
430/4	Cicero	A. C. Smith ..	Scottish Exam.	3.1.12	..
439/4	Coleshill Jolly King	P. Lock.. ..	English Exam. ..	15.2.12	..
594/4	Comet	Brock Bros. ..	Trafalgar ..	29.8.12	R.G.
608/4	Commander ..	Jeffrey Bros. ..	Whittlesea ..	9.9.12	R.N.J.
583/4	Clydesdale Bill ..	H. Schnieder ..	Hamilton ..	22.8.12	R G.
588/4	Clydesdale Prince ..	E. and A. Breen	Kyabram ..	22.8.12	E.A.K.
461/4	Coronation ..	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
526/4	Coronation Prince ..	C. Cornish ..	Bendigo (Special)	1.8.12	R.G.
482/4	Cranbourne Stewart	E. J. Glossop ..	Agricultural Offices	6.7.12	R.G.
561/4	Creslow Kingmaker	Geelong Harbour Trust	Geelong ..	13.8.12	E.A.K.
490/4	Cross-in-hand Charmer	F. E. Coster ..	English Exam. ..	16.2.12	..
469/4	Crown Tenant ..	W. Langley ..	Horsham ..	2.7.12	R.N.J.

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
431/4	Curler	J. R. McKenzie	Scottish Exam.	3 1 12	..
511/4	Darnley's Pride of Rythsdale	Sims Bros.	Newmarket	22.7.12	R N.J.
587/4	Defender	D. McNamara	Rochester	20.8.12	E A.K.
557/4	Defender	Hooper Bros.	Benalla	15.8.12	R.G.
448/4	Diamond King	J. Leitch	Newmarket (Special)	6.5.12	E.A.K.
565/4	Dividend	M. Cann	Euroa	16 8 12	R.G.
432/4	Donibristle	Exors. late T. Wilson	Scottish Exam.	3.1.12	..
579/4	Dreadnought	J. C. Rockliffe	Numurkah	23.8.12	R.N.J.
573/4	Drummer's Style	N. Anderson	Murchison	22.8.12	R.N.J.
484/4	Dunsby Victor II.	A. and J Young	Horsham	2.7.12	R N.J.
481/4	Dunsmore Ragged Jacket	W. Price-Jones	English Exam.	16.2.12	..
457/4	Eaton Charmer	M. J. Caffrey	Newmarket (Special)	17.6 12	E.A.K.
489/4	Elksley Commander	J. J. Carroll	English Exam.	27.3.12	..
547/4	Favourite	—. Hannah	Donald	7.8.12	R.N J.
519/4	First Choice	R. H. Lanyon	Boort	30.7.12	R.G.
533/4	Flashwood's Model	C. Mason	Warracknabeal	2.8.12	E.A.K.
475/4	Fortune Laddie	D. McPherson	Horsham	3.7.12	R.N.J.
629/4	Forward	R. Calls	Foster	16 9.12	R.G.
433/4	Fred	J. R. McKenzie	Scottish Exam.	3.1.12	..
550/4	Fyvie Blacon	A. J. Glen	Birchip	9.8.12	R.N.J.
496/4	Gaer Conqueror	C. Payne	City Horse Bazaar	15.7.12	R.G.
472/4	Gamekeeper	Hermann Hill	Horsham	2 7.12	R.N.J.
642/4	Gay Gordon	J. Ferguson	Swan Hill	25.9.12	R.N.J.
434/4	General Douglas	R. Kennedy	Scottish Exam.	3.1.12	..
449/4	Glencoe Glen Lyon	A. Robertson	Newmarket (Special Exam.)	6.5.12	E.A.K.
421/4	Glen Donald	J. Henderson	Leongatha (Special Exam.)	27.2.12	W.J.C.
436/4	Glengonna	F. Foubisher	Scottish Exam.	3.1.12	..
536/4	Glenmuick	J. Clark	Yarrawonga (Special Exam.)	2 8.12	R.G.
497/4	Goldfinder	E. A. Weekes	City Horse Bazaar	15.7.12	R.G.
514/4	Good Enough	John Mills	Newmarket	23.7.12	R.N.J.
531/4	Hampton Ben	H. Allen	Beulah	1.8.12	E.A.K.
627/4	Heather Lad	Benson Bros.	Bacchus Marsh	14.9.12	R.G.
638/4	Hiawatha	A. L. Hamilton	Corryong	18 9.12	R.N.J.
477/4	Highland Prince	F. Mentha	Horsham	3.7.12	E A.K.
593/4	His Lordship	R. Jack and Son	Rutherglen	26 8.12	E.A.K.
628/4	His Majesty	E. J. Rickey	Smeaton	12.9 12	R.N.J.
621/4	Invincible	Tallent Bros.	Ballarat	14.9.12	R.N.J.
507/4	Jack's the Lad	J. Bird	City Horse Bazaar	17.7.12	W.J.C.
631/4	Kelm's Best	J. Gooley	Leongatha	16.9.12	R.G.
570/4	Kelvin's Fancy	J. J. Murphy	Rainbow	8.8.12	R.G.
606/4	Kingston	Henebery and Hawkins	Sale	12.9 12	R.G.
537/4	Kinloch Again	W. T. Bodey	Murtoa	31.7.12	E.A.K.
445/4	Kittrick Dale	S E. Roberts	Scottish Exam.	15.2.12	..
476/4	Kingfisher	R. P. Young	Horsham	3.7.12	R.N.J.
498/4	King George	A. L. and E. M. Walter	City Horse Bazaar	15.7.12	R.G.
641/4	Laird of Glengarry	G. Hopwood and Son	Ballan	26.9.12	E.A K.
623/4	Landlord	D. McCallum	Ballarat	14.9.12	R.N.J.
615/4	Latest Fashion	J. Phalp	Colac	13.9.12	E.A.K.
450/4	Laudevar	Alex. Robertson	Newmarket (Special)	6.5.12	E.A.K.
467/4	Leonard	W. Price-Jones	English Exam.	2.3.12	..
609/4	Loch Allen	Thos. Smith	Whittlesea	9.9.12	R.N.J.
534/4	Longford's Fashion	J. Gildea	Warracknabeal	2.8.12	E.A.K.
485/4	Lowesby Masterpiece	A. and J. H. Young	Horsham	2.7.12	R.N.J.
632/4	Lymm Champion II.	E. Wilson	Leongatha	16.9.12	R.G.
458/4	Lymm Raider	J. Caffrey	Newmarket (Special)	17.6.12	E.A.K.
639/4	Lord Donald	A. Harris	Corryong	18.9.12	R.N.J.
624/4	Lord Dundee	J. J. Downey	Ballarat	14.9.12	R.N.J.
512/4	Lord Islington	Exors. late R. Hornbuckle	Newmarket	22.7.12	E.A.K

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
			DRAUGHTS—*continued.*		
465/4	Lord Kelvin	J. White	City Horse Bazaar	18.6.12	R.G.
590/4	Lord Mitchell	H. McLaren	Shepparton	23.8.12	E.A.K.
650/4	Major Eddy	H. Hall	Agricultural Offices	1.3.13	R.N.J.
506/4	Major's Pride	Stuckey Bros.	City Horse Bazaar	16.7.12	E.A.K.
580/4	Mark Ward	J. Schinnick	Numurkah	23.8.12	R.N.J.
479/4	Marton Peacemaker	W. Price-Jones	English Exam.	16.2.12	..
480/4	Marton Zealot	J. Flanagan	English Exam	16.2.12	..
643/4	Matoura	McGorran Bros	Morwell	1.10.12	R.N.J.
440/4	Mayland's Dray King	G. Goldsmith	English Exam	15.2.12	.
441/4	Medlar Harold	F. W. Griffin	English Exam.	15.2.12	..
544/4	Model Prince	John Giffard	St. Arnaud	6.8.12	R.N.J.
541/4	Moravian	H. Boyd	Elmore	9.8.12	E.A.K.
466/4	Nailstone Buchanan	W. Price-Jones	Newmarket (Special)	28.6.12	E.A.K.
468/4	Nailstone Jew	W. Price-Jones	English Exam	16.2.12	..
602/4	Neotsfield Rufus	John Munro	Royal Show	2.9.12	R.G.
553/4	Never Despair	Thos. Kelly	Inglewood	13.8.12	R.N.J.
576/4	Newton's Best	J. J. McCarron	Nathalia	20.8.12	R.N.J.
607/4	Noble King	W. A. Hammill	Sale	12.9.12	R.G.
554/4	Perfection	N. Ramsay	Inglewood	13.8.12	R.N.J.
568/4	Premier	G. Smith	Rosedale (Special)	15.8.12	R.G.
559/4	Premier Lauder	P. Kelleher	Benalla	15.8.12	R.G.
592/4	Premier Montgomery of Willowbank	Undera Syndicate	Shepparton	23.8.12	E.A.K.
566/4	Premier McNab	John Burns	Euroa	16.8.12	R.G.
515/4	Pride of Fashion	W. Walter	Lara (Special Exam.)	25.7.12	E.A.K.
581/4	Prince Cedric	J. Jeffrey	Numurkah	23.8.12	R.N.J.
622/4	Prince Imperial	J. Mansfield	Kyneton	10.9.12	R.N.J.
530/4	Prince Thornley	C. McFarlane	Hopetoun	30.7.12	E.A.K.
513/4	Quality Prince	J. Bodey	Newmarket	22.7.12	R.G.
552/4	Rantin Robin	J. Clark	Maryborough	12.8.12	R.N.J.
563/4	Referendum	J. F. Farrer	Geelong	13.8.12	E.A.K.
478/4	Royal Ben	A. C. Hatley	Horsham	3.7.12	E.A.K.
635/4	Royal Carlyle	R. H. Biggar	Korumburra	18.9.12	R.G.
500/4	Royal Champion	W. Hercus	City Horse Bazaar	15.7.12	E.A.K.
625/4	Royal Prince	W. Lewin	Ballarat	14.9.12	R.N.J.
586/4	Royal Review	Mitchell and O'Brien	New South Wales Exam.	2.8.12	..
451/4	Royal Review	A. Robertson	Newmarket (Special)	6.5.12	E.A.K.
577/4	Royal Robin	P. and R. Ferrar	Nathalia	20.8.12	R.N.J.
614/4	Royalty	Roberts Bros.	Daylesford	13.9.12	R.N.J.
470/4	Royal Willie	A. Boyd	Horsham	2.7.12	R.N.J.
545/4	Scarcliffe Momento	E. G. Bath	St. Arnaud	6.8.12	R.N.J.
473/4	Scotland Yet	J. Coles and Sons	Horsham	2.7.12	R.N.J.
538/4	Scottish Lad	Alex. Hoff	Murtoa	31.7.12	E.A.K.
636/4	Scottish Pride	A. J. Tozer	Korumburra	18.9.12	R.G.
501/4	Sir Baron	Thompson Bros.	City Horse Bazaar	15.7.12	E.A.K.
463/4	Sir Ivor	Mitchell and O'Brien	City Horse Bazaar	18.6.12	R.G.
520/4	Sir John Small	D. Blair	Boort	30.7.12	R.G.
555/4	Sir Regulus	W. Howe	Inglewood	13.8.12	R.N.J.
464/4	Sir Rudolph	R. Clarke	City Horse Bazaar	18.6.12	E.A.K.
502/4	Sir Walter Ryal Bush	H. S. Graham	City Horse Bazaar	15.7.12	E.A.K.
474/4	Sir Walter Scott	H. Whisson	Horsham	2.7.12	R.N.J.
551/4	Southern Star	H. Green	Birchip	9.8.12	R.N.J.
626/4	Statesman	N. C. Teychenne	Melbourne (Special)	14.9.12	R.N.J.
443/4	Tibberton Dray King	T. Withers and Sons	English Exam.	28.12.11	..
637/4	Top Sail	Olsen and Hammond	Korumburra	18.9.12	R.G.
437/4	Topsman	J. R. McKenzie	Scottish Exam.	3.1.12	..
503/4	Tweedside Again	J. A. Mitchell and Co.	City Horse Bazaar	15.7.12	R.N.J.
454/4	The Earl	Department of External Affairs	City Horse Bazaar (Special)	20.5.12	E.A.K.
560/4	The Premier	T. Haley, jun.	Benalla	15.8.12	R.G.
589/4	The Star	J. McLeod	Kyabram	22.8.12	E.A.K.
610/4	The Squatter	J. H. Cornfoot	Whittlesea	9.9.12	R.N.J.
548/4	Waironga Prince	W. Blair	Watchem	8.8.12	R.N.J.

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
564/4	Warkworth ..	W. Grant ..	Geelong ..	13.8.12	E.A.K.
471/4	Warkworth King ..	B. Ellyett ..	Horsham ..	2.7.12	R.N.J.
539/4	Warranooke ..	A. Anderson ..	Murtoa . ..	31.7.12	E.A.K.
556/4	Young Dundonald ..	H. Williamson ..	Myrtleford ..	14.8.12	R.G.
504/4	Young Ivanhoe ..	Mitchell and Co.	City Horse Bazaar	15.7.12	R.N.J.
569/4	Young Kakamatua	R. Nimmo .	Minyip	8.8.12	R.G.
648/4	Young Timekeeper	Anderson Bros.	Berwick (Special)	19.11.12	E.A.K.
611/4	Young Up-to-Date	H. J. Rix ..	Dandenong ..	11.9.12	R.N.J.
		LIGHT HORSES.			
549/4	Abby	Harricks Bros. ..	Ararat	9.8.12	R.G.
595/4	Direction	R. R. Corbould ..	Mildura ..	27.8.12	R.N.J.
540/4	Direct Speed ..	E. Pay ..	Kerang	9.8.12	E.A.K.
543/4	Echo .. .	E. G. Bath ..	St. Arnaud ..	6.8.12	R.N.J.
452/4	Electric Bells ..	P. S. Spark ..	Caulfield (Special)	2.5.12	E.A.K.
584/4	Fakreddin.. ..	Hon S. W. Cooke	Hamilton ..	22.8.12	R.G.
523/4	First Voyage ..	W. Greaves ..	Bendigo ..	31.7.12	R.G.
630/4	Gay Bells ..	J. D. Symons ..	Leongatha ..	16.9.12	R.G.
620/4	Glen Alvie .	J. Wade ..	Ballarat ..	14.9.12	R.N.J.
524/4	Harold Direct ..	T. Cawsey ..	Bendigo ..	31.7.12	R.G.
562/4	Highland Cleve ..	T. Larcombe ..	Geelong ..	13.8.12	E.A.K.
376/4	Lord Lincoln ..	G. Trigg ..	Colac ..	13.9.12	E.A.K.
601/4	Lubricator ..	Opie Bros. ..	Royal Show ..	2.9.12	R.N.J.
640/4	Oaklands	A. Porteous ..	Ballarat ..	14.9.12	R.N.J.
525/4	Oakwood King ..	R. Matchett ..	Bendigo ..	31.7.12	R.G.
634/4	Odd Patch ..	G. A. Finlay ..	Korumburra ..	18.9.12	R.G.
591/4	Perfection ..	E. Baker ..	Shepparton ..	23.8.12	E.A.K.
613/4	Preston Junior .	McClure Bros. ..	Kyneton ..	10.9.12	R.N.J.
529/4	Prince Harold .	C. Darley ..	Hopetoun .	30.7.12	E.A.K.
604/4	Silver Bells .	A. G. McClements	Traralgon ..	11.9.12	R.G.
535/4	Sir Carlaw ..	J. Bunge ..	Warracknabeal ..	2.8 12	E.A.K.
647/4	Sir Dominant ..	Colclough Bros. ..	Ballarat Show (Special)	14.11.12	E.A.K.
518/4	Sparkling Bells ..	Tye Bros. ..	Melbourne(Special)	31.7 12	W.J.C.
605/4	Walter Bell Boy ..	A. West ..	Bairnsdale ..	11.9.12	R.G.
571/4	Yarpeet	J. Fisher ..	Rainbow ..	6.8.12	R.G.
		PONIES.			
596/4	Advance	L. Harper ..	Rutherglen ..	26.8.12	E.A.K.
646/4	Almont Hero ..	T. Kenny ..	Ballarat (Special)	14.11.12	E.A.K.
617/4	Bobs	W. H. Podger ..	Camperdown ..	11.9.12	E.A.K.
499/4	King Leo	R. J. Nink ..	City Horse Bazaar	15.7.12	E.A.K.
558/4	Little Wonder II. ..	H. Burness	Benalla	15.8.12	R.G.
603/4	Prince Leo III. ..	J. R. Brien ..	Royal Show ..	2.9.12	R.N.J.
649/4	Sir Rupert ..	A. McKinnon ..	Wahgunyah (Special)	18.1.13	E.A.K.
645/4	Wee MacGregor .	J. Hammill ..	Orbost	3.10.12	R.N.J.
483/4	What's Wanted III.	Miss S. L. Robinson	Agricultural Offices (Special)	6.7.12	R.G.

(Three-year-old Certificates expiring 30th June, 1913.)

DRAUGHTS.

847/3	Abbeydale ..	Mitchell and O'Brien	Scottish Exam. ..	15.2.12	..
822/3	Abbot's Own ..	Robertson and McKenzie	Newmarket (Special)	26.4.12	E.A.K.
855/3	Abbot's Pride ..	Hon. S. W. Cooke	Hamilton ..	17.6.12	R.N.J.
971/3	Admiral Byng ..	G. Cropley ..	New Zealand Exam.	30.5.12	..
1012/3	Admiral Howard ..	R. W. Herkes ..	New Zealand Exam.	30.5.12	..
970/3	Admiral Nelson ..	J. Jeffrey ..	New Zealand Exam.	30.5.12	..
870/3	Advocate	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
964/3	Agitator's Heir ..	James Langford ..	New Zealand Exam.	19.6.12	..

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
1019/3	Allandale	T. Davern ..	Newmarket ..	22.7.12	E.A.K.
929/3	Allan Raine ..	J. E. Small .	Agricultural Offices	13.7.12	R.N.J.
1014/3	Allanton .. .	J. Patrick ..	New Zealand Exam.	1.6.12	..
903/3	Alston Prince Albert	W. Price-Jones .	Newmarket (Special)	28.6.12	E.A.K.
871/3	Ambassador .	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
944/3	Ambastone Combine	W. Price-Jones .	English Exam. ..	21.2.12	..
1020/3	Archer	W. R. Smith .	Newmarket .	22.7.12	E.A.K.
965/3	Argyle .. .	J. Drain .	Agricultural Offices	15.7.12	E.A.K.
980/3	Ashton Lad ..	R. Allen ..	City Horse Bazaar	15.7.12	E.A.K.
1086/3	Atlas .. .	R. C. Hannah .	Donald .. .	7.8.12	R.N.J.
823/3	Aynsley Lad ..	J. R. Henry .	Newmarket (Special)	26.4.12	E.A.K.
930/3	Bainton	O. E. Bodey	Agricultural Offices	13.7.12	R.N.J.
872/3	Bancor's Pride .	G. Allardice ..	City Horse Bazaar	18.6.12	R.G.
981/3	Baron Again .	M. McMicking .	City Horse Bazaar	15.7.12	R.N.J.
1154/3	Baron Barnton .	A. Watson, jun. .	Kyneton ..	10.9.12	R.N.J.
907/3	Baron Black .	J. D. Mitchell ..	New Zealand Exam.	31.5.12	..
972/3	Baron Black .	E. O'Keefe ..	New Zealand Exam.	30.5.12	..
1011/3	Baron Clyde .	A. W. Cunnington	New Zealand Exam.	30.5.12	..
982/3	Baron Cranley ..	A. Davidson .	City Horse Bazaar	15.7.12	E.A.K.
824/3	Baron Fancy ..	J. R. Henry ..	Newmarket (Special Exam.)	26.4.12	E.A.K.
1083/3	Baron Laddie .	A. McLennan ..	Heathcote .	5.8.12	R.N.J.
983/3	Baron Lane .	J. Sullivan .	City Horse Bazaar	15.7.12	R.G.
825/3	Baron Lough ..	Gerrard Bros. ..	Newmarket (Special Exam.)	26.4.12	E.A.K.
826/3	Baron McLean ..	D. W. Stewart ..	Newmarket (Special Exam.)	26.9.12	E.A.K.
827/3	Baron Rae ..	J. Hamilton ..	Newmarket (Special)	26.4.12	E.A.K.
1137/3	Baron's Gem ..	R. Carroll .	Royal Show .	2.9.12	R.G.
828/3	Baron's Pride ..	J. R. Henry	Newmarket (Special)	26.4.12	E.A.K.
1002/3	Baron Thistle	J. D. Mitchell .	New Zealand Exam.	31.5.12	..
1149/3	Baron Watson ..	W. T. Manifold ..	New Zealand Exam.	1 6.12	..
1009/3	Black Prince ..	S. J. Lynn .	New Zealand Exam.	17.6.12	..
909/3	Bold Charmer ..	T. Sherwood ..	Horsham .	2.7.12	R.N.J.
931/3	Bonnie Garthland ..	J. E. Small ..	Agricultural Offices	13.7.12	R.N.J.
829/3	Bonnie McFarlane ..	Robertson and McKenzie	Newmarket (Special)	26.4.12	E.A.K.
814/3	Boro' Jameson II. ..	Reilly Bros. ..	English Exam. ..	15.2.12	..
816/3	Boro' Lion ..	F. W. Griffin ..	English Exam. ..	15.2.12	..
817/3	Boro' Ranger ..	W. T. Bodey ..	English Exam. ..	15.2.12	..
873/3	Bosun	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
1021/3	Bothwell	A. E. Godden ..	Newmarket ..	22.7.12	R.N.J.
1007/3	Bounding Alexander	R. H. Webb ..	New Zealand Exam.	17.6.12	..
874/3	Boy Scout ..	Mitchell and O'Brien	City Horse Bazaar	18.6.12	R.G.
984/3	Bright Laddie ..	M. Simpson ..	City Horse Bazaar	15.7.12	R.N.J.
875/3	Britannic	A. Bowman ..	City Horse Bazaar	18.6.12	E.A.K.
1057/3	Briton Again .	G. L. Claxton ..	New Zealand Exam.	13.5.12	..
1179/3	Brookdale ..	J. T. Poynton ..	Ensay (Special) ..	8.10.12	E.A.K.
876/3	Captain	Mitchell and O'Brien	City Horse Bazaar	18.6.12	R.G.
973/3	Captain Cook ..	J. W. Blair ..	New Zealand Exam.	30.5.12	..
830/3	Captain Everest ..	J. R. Henry ..	Newmarket (Special Exam.)	26.4.12	E.A.K.
1006/3	Captain Merton ..	S. J. Lynn ..	New Zealand Exam.	30.5.12	..

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
974/3	Captain Scott ..	Hon. Simon Fraser	New Zealand Exam.	30.5.12	..
1077/3	Cardigan	T. Connor ..	Swan Hill ..	7.8.12	E.A.K.
1070/3	Casabianca .	A. T Treloar .	Beulah	1.8.12	E.A.K.
924/3	Castle Ray ..	W. Johns ..	Horsham ..	3.7.12	R.N.J.
939/3	Cincinatti ..	S. P. and W. H. Allan	Horsham .	3.7.12	E.A.K.
877/3	Commander .	D. Menzie ..	City Horse Bazaar	18.6.12	R.G.
856/3	Commodore	Caffrey and Murphy	Newmarket (Special)	17.6.12	E.A.K.
954/3	Clifton Colonel .	W. Price-Jones ..	English Exam. ..	16 2.12	..
831/3	Cloverdale ..	Robertson and McKenzie	Newmarket (Special)	26.4.12	E.A.K.
987/3	Clydebank Again ..	W. McGaffin .	City Horse Bazaar	15.7.12	R.G.
920/3	Clyde Boy ..	C. Reinheimer ..	Horsham .	2.7.12	R.N.J.
1047/3	Cock of the North ..	Burge Bros. .	Newmarket ..	23.7.12	E.A K.
992/3	Cooringa ..	J. O'Brien ..	City Horse Bazaar	16.7.12	E A K.
919/3	Coree .. .	Parish and Huf ..	Horsham	2.7.12	R.N.J.
878/3	Count Everest .	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E A.K.
1003/3	Craig Athol ..	J. D. Mitchell .	New Zealand Exam.	31.5.12	.
832/3	Craigie Champion ..	J. R. Henry ..	Newmarket (Special)	26.4.12	E.A K.
1043/3	Craigie's King ..	D. Clark .	New Zealand Exam.	14.6 12	.
1106/3	Cremoran's Pride ..	W. Henneberg .	Rainbow	6 8.12	R G.
857/3	Crown Prince .	Caffrey and Murphy	Newmarket (Special)	17.6 12	E.A.K.
1022/3	Culham Menestral ..	J. R. Henry	Newmarket .	22.7.12	E.A.K.
879/3	Cup Winner	Mitchell and O'Brien	City Horse Bazaar	18.6.12	R.G.
1023/3	Dalmuir King ..	J. Guthrie ..	Newmarket .	22.7.12	R.G.
833/3	Dalmuir Rob ..	L. Semmens ..	Newmarket (Special)	26.4.12	E A.K.
943/3	Debden Conqueror .	W. Price-Jones ..	Newmarket (Special Exam.)	28 6.12	E.A.K.
952/3	Demonstrator ..	C. Carra ..	New Zealand Exam.	1.6.12	..
1052/3	Derby Lad ..	H. Moss ..	Agricultural Offices	20.7.12	R.N.J.
1017/3	Donald Mac ..	W. J. Craig .	City Horse Bazaar	18.7.12	Appeal Board
858/3	Donald Mack ..	W. Curtain ..	Newmarket (Special)	17.6.12	E.A.K.
1085/3	Donald's Pride II. ..	J. C. Braeur ..	Jeparit	7.8.12	R.G.
940/3	Don McDonald .	E. Koenig ..	Horsham ..	3.7.12	E.A.K.
859/3	Drew's Pride ..	C. Parsons ..	Newmarket (Special)	17.6 12	R.N.J.
955/3	Duke XXI. .	W. Price-Jones ..	English Exam. ..	16.2.12	..
1013/3	Dukedom	T. Edney ..	New Zealand Exam.	1.6.12	..
851/3	Duke of Croskill ..	Mitchell and O'Brien	N.S.W. Exam. ..	1.4 12	..
945/3	Dunchurch Boy ..	W. Price-Jones ..	English Exam. ..	16.2.12	..
956/3	Dunchurch Prince ..	W. Price-Jones ..	English Exam. ..	16.2.12	..
1104/3	Duncraig Again ..	L. McLeod ..	New Zealand Exam.	14.5.12	..
1078/3	Dundonald ..	G. Neild ..	Swan Hill ..	7.8.12	E.A.K.
1053/3	Dundonald's Hero ..	J. Douglas ..	Charlton ..	18.7.12	G.H.
1115/3	Dunedin	R. and J. Dickson	Hamilton ..	22.8.12	R.G.
1076/3	Dun Lea	A. McKinnon ..	Pyramid ..	5.8.12	E.A.K.
1072/3	Dunrobin's Pride ..	D. Sutherland ..	Kerang	9.8.12	E.A.K.
957/3	Dunsby Friar II. ..	W. Price-Jones ..	English Exam. ..	15.2.12	..
1100/3	Dunsmore's Pride ..	T. A. Griffith ..	Benalla	15.8.12	R.G.
880/3	Durbar	J. M. Phillips ..	City Horse Bazaar	18.6.12	E.A.K.
958/3	Eaton Combination..	W. Price-Jones ..	English Exam. ..	21.2.12	..
860/3	Eaton Ensign ..	W. Hicks ..	Newmarket (Special)	17.6.12	R.N.J.
1016/3	Electric	Smythe Bros. ..	City Horse Bazaar	18.7.12	Appeal Board

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
1129/3	Ettrick Sir ..	J. Bradshaw ..	Trafalgar ..	29.8.12	R.G.
852/3	False Colours ..	T. Roche ..	N.S.W. Exam. ..	1.4.12	..
1182/3	Federal Dick ..	A. Mason ..	Agricultural Offices	9.10.12	R.N.J.
1068/3	Federation's Pride ..	F. R. Burns ..	Goroke	31.7.12	G.H.
953/3	First Choice ..	C. W. Schultz ..	New Zealand Exam	1.6.12	..
1024/3	Flowerdale Prince ..	A. R. Wilson ..	Newmarket ..	22.7.12	E.A.K.
1121/3	Fusilier .. .	D and M. McLeod	Sth Aust. Exam.	8.7.12	..
881/3	Fyvie	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
834/3	Gallant Boy ..	J R. Henry ..	Newmarket (Special)	26.4.12	E.A.K.
975/3	Gallant Prince ..	Yeo Stokes ..	New Zealand Exam.	30.5.12	..
1139/3	Garthland Again ..	Brady Bros. ..	Royal Show ..	2.9.12	R.G.
1048/3	Gay City	E. Vincent ..	Newmarket ..	23.7.12	E.A.K.
882/3	Gay Gordon ..	A. W. Warren ..	N.S.W. Exam. ..	1.4.12	..
1080/3	General McDonald ..	J. Vickers ..	Elmore	9.8.12	E.A.K.
1181/3	Glenallan	A. J. Tozer ..	Scottish Exam. ..	13.1.12	..
1164/3	Glencairne's Pride ..	P. Jeffrey ..	Bacchus Marsh .	14.9.12	R.G.
1025/3	Glenfarg	J. Bodey ..	Newmarket ..	22.7.12	R.N.J.
1113/3	Glen Gairn ..	J. MacGregor ..	Numurkah ..	23.8.12	R.N.J.
1166/3	Glengerrie ..	R. Cowie .	Smeaton ..	12.9.12	R.N.J.
988/3	Glen Lyon ..	W. McGaffin ..	City Horse Bazaar	16.7.12	R.G.
1001/3	Glen Markie ..	M. McCormack ..	New Zealand Exam.	12.6.12	..
937/3	Glenmarkie ..	D. McRae ..	City Horse Bazaar	15.7.12	R.N.J.
1026/3	Glenryan	W. Hill ..	Newmarket ..	22.7.12	R.N.J.
1117/3	Gold Link.. ..	C. Rhodes ..	Casterton .	21.8.12	R.G.
2153/3	Good Game ..	W. French ..	Scottish Exam. .	3.1.12	..
1136/3	Gowan Brae ..	R. I. Argyle ..	Royal Show ..	2.9.12	R.N.J.
1108/3	Grand Emerald ..	Guiton Bros. ..	Rushworth ..	22.8.12	R.N.J.
989/3	Handsome Jack ..	W. McGaffin ..	City Horse Bazaar	15.7.12	R.G.
1027/3	Harry Lauder ..	J. R. Henry ..	Newmarket ..	22.7.12	R.N.J.
1051/3	Hector Dillon ..	K. Cameron ..	New Zealand Exam.	13.5.12	..
1028/3	Hector McDonald ..	W. Foubister ..	Newmarket ..	22.7.12	E.A.K.
946/3	Hero	Cain Bros. ..	Agricultural Offices	6.7.12	R.G.
1073/3	Hero's Pride ..	W. Dowling ..	Kerang	9.8.12	E.A.K.
916/3	Highland Chief ..	Noske Bros. ..	Horsham ..	2.7.12	R.N.J.
850/3	Highland Laddie ..	M. Lowry ..	N.S.W. Exam. ..	1.4.12	..
947/3	Hindmaster ..	A. Chrystal ..	Agricultural Offices	6.7.12	R.G.
1094/3	Honest Major ..	J. H. Meyer ..	Kaniva ..	15.8.12	E.A.K.
1061/3	Horace's Pride ..	M. Walter ..	New Zealand Exam.	14.5.12	..
883/3	Invergowrie ..	M. McMicking ..	City Horse Bazaar	18.6.12	R.G.
926/3	Jackson	J. Mitchell ..	Horsham ..	3.7.12	R.N.J.
884/3	Jack Tar	Dean Bros. ..	City Horse Bazaar	18.6.12	E.A.K.
1132/3	Jamieson	J. J. Lawless ..	Yarrawonga ..	27.8.12	E.A.K.
1029/3	Jock Flashlight ..	P. Quillian ..	Newmarket ..	22.7.12	R.N.J.
1105/3	Kaiwera Knight ..	J. S. Feehan ..	New Zealand Exam.	13.5.12	..
1172/3	Keim's Champion ..	D. McDonald ..	Ballan	26.9.12	E.A.K.
853/3	Kelvin Grove ..	Mitchell and O'Brien	N.S.W. Exam. ..	3.4.12	..
861/3	Kildare	Caffrey and Murphy	Newmarket (Special)	17.6.12	E.A.K.
976/3	King Alexander ..	H. Malouf ..	New Zealand Exam.	30.5.12	..
1114/3	King Carlos ..	Hansen Bros. ..	Numurkah ..	23.8.12	R.N.J.
1122/3	King George ..	C. Slattery ..	Rochester ..	20.8.12	E.A.K.
885/3	King George ..	J. G. Chaston ..	City Horse Bazaar	18.6.12	R.G.
890/3	King Newton ..	J. B. Macarthur ..	City Horse Bazaar	18.6.12	R.G.
1049/3	King's Own ..	J. Denham ..	New Zealand Exam.	1.6.12	..
936/3	King's Quality ..	M. Hearne ..	City Horse Bazaar	15.7.12	R.N.J.
818/3	King's Walden Conqueror	T. Robson ..	English Exam. ..	15.2.12	..
966/3	Kinross	Hon. Simon Fraser	Agricultural Offices	13.7.12	E.A.K.
908/3	Knight Burnbank ..	J. D. Mitchell ..	New Zealand Exam.	31.5.12	..
1065/3	Laddie's Pride ..	C. W. Raleigh ..	Bendigo (Special) Exam.	1.8.12	R.G.

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
886/3	Laird o' Gowrie .	T. Kennedy .	City Horse Bazaar	18.6.12	R.G.
948/3	Laird of Lochiel ..	O'Neil Bros. .	Agricultural Offices	6.7.12	R G.
977/3	Laird of Newton .	A. L. and E. M Walter	New Zealand Exam.	30.5.12	..
917/3	Lanark's Pride ..	R. Dickinson .	Horsham .	2.7.12	R.N.J.
1109/3	Legislator .	W. H Ludemann	Dookie	19.8.12	R.N.J.
959/3	Lilburne Regent .	W. Price-Jones ..	English Exam. .	16 2.12	.
1116/3	Lochinvar .	McDonald Bros. .	Hamilton ..	22.8 12	R.G.
819/3	Long Lawford Chief	F W. Griffin ..	English Exam. ..	15.2.12	..
1059/3	Lookout	J. Dunn ..	New Zealand Exam.	13.5.12	..
1160/3	Lucky Charm .	D. Williamson ..	Ballarat .	14.9.12	R.N.J.
863/3	Lymm Prime Minister	M. J Caffrey ..	Newmarket (Special Exam.)	19 6.12	R.N.J
986/3	Lyon King .	J. White ..	City Horse Bazaar	15.7.12	R G
887/3	Lord Bothwell ..	W. Walter .	City Horse Bazaar	18.6 12	E.A.K.
1144/3	Lord Carrick	Jelbart and Sons.	New Zealand Exam.	14 6.12	.
1042/3	Lord Churchill .	D Clarke .	New Zealand Exam	14 6.12	..
1030/3	Lord Cranbourne II.	M. & M B W. .	Newmarket .	22.7.12	R G.
862/3	Lord Dudley .	J H. Hall .	Newmarket (Special)	17.6.12	R.N.J.
888/3	Lord Elgin ..	Mitchell and O'Brien	City Horse Bazaar	18 6.12	E.A.K.
963/3	Lord Kelly ..	McCarthy Bros. ..	New Zealand Exam.	9 4.12	..
991/3	Lord McDonald .	J. Stokes ..	City Horse Bazaar	15.7.12	E.A.K.
1167/3	Lord Nelson .	E. J. Brown ..	Corryong .	18.9.12	R N.J
1087/3	Lord Plunton .	R. C. Hannah .	Donald . .	7 8.12	R.N J.
1088/3	Lord Shepherd .	Noske Bros. .	Ararat .. .	9.8 12	R.G.
1176/3	McGregor's Pride ..	J. Russell, jun. .	Orbost	3.10.12	R N.J.
1062/3	Mack's Pride .	R. N. Herkes .	New Zealand Exam.	14.5.12	..
1018/3	Mac's Pride .	Mitchell and O'Brien	City Horse Bazaar	18.7.12	Appeal Board
922/3	MacTartan ..	A. McLennan ..	Horsham ..	2.7.12	R.N.J.
835/3	Major Cranley .	J. R. Henry .	Newmarket (Special)	26.4 12	E.A K.
889/3	Major Sentinel .	T. Kennedy .	City Horse Bazaar	18.6.12	R G.
1151/3	Major's Best ..	Stuckey Bros.	Traralgon	11.9 12	R G.
854/3	Marmion	Mitchell and O'Brien	New South Wales Exam.	3.4.12	.
1031/3	Marshall Mills ..	J. Tweedle ..	Newmarket ..	22.7.12	E.A K.
993/3	Maxwell	J. Stokes ..	City Horse Bazaar	15.7.12	E A.K.
836/3	Military	J. R. Henry ..	Newmarket (Special Exam)	26.4.12	E.A.K.
1169/3	Milton Park ..	Bain Bros. ..	Yarram ..	18.8.12	R G.
1092/3	Model Mills .	D. Johns ..	Warragul ..	16.8.12	R.N.J.
864/3	Moira Everlasting ..	J. H. Hall ..	Newmarket (Special)	17.6.12	E.A.K.
932/3	Mount Everest ..	J. A. McKenzie ..	Agricultural Offices	13.7.12	R.N.J.
837/3	Newton Laddie ..	J. R. Henry ..	Newmarket (Special Exam.	26.4.12	E.A.K.
1173/3	Newton's Best ..	W. H. Bell ..	Wangaratta (Special Exam.)	25.9.12	R.G.
891/3	Noble Lad ..	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
838/3	Noble Shepherd ..	D. R. McLeod ..	Newmarket (Special)	26.4.12	E.A.K.
1004/3	Pacific	S. G. Jaffrey ..	City Horse Bazaar	22.7.12	W.J.C.
902/3	Pioneer	Mitchell and O'Brien	Melbourne (Special)	25.6.12	R.G.
1135/3	Politician	A. Dunning ..	Tungamah ..	27.8.12	E.A.K.
848/3	Premier Carmichael	Paterson Bros. ..	Romsey (Special) Exam.)	10.5.12	R.G.
994/3	Premier Dowling ..	A. Davidson ..	City Horse Bazaar	15.7.12	E.A.K.
865/3	Premier Prince	McDonald and Son	Newmarket (Special)	17.6.12	E.A.K.
967/3	President Lincoln ..	Jas. Cobain ..	Agricultural Offices	13.7.12	R.G.
923/3	Propeller	W. J. Pilgrim ..	Horsham ..	3.7.12	R.N.J.
1005/3	Pride of Gladstone	S. J. Lynn ..	New Zealand Exam.	30.5.12	..

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
978/3	Pride of Milton ..	J. McKenzie ..	New Zealand Exam.	30.5.12	..
995/3	Pride of the Valley..	W. McGaffin ..	City Horse Bazaar	15.7.12	R.G.
1032/3	Prince	A. McDonald ..	Newmarket ..	22.7.12	R.N.J.
1060/3	Prince Erskine ..	J. Tyros ..	New Zealand Exam.	13.5.12	..
892/3	Prince Harold ..	Miss B. Reid ..	City Horse Bazaar	18.6.12	E.A.K.
1000/3	Prince Imperial ..	A. Collins ..	New Zealand Exam.	21.5.12	..
1155/3	Prince of Albyn ..	P. O'Donnell ..	Kyneton ..	10.9.12	R.N.J.
893/3	Prince of Fashion ..	W. Walters	City Horse Bazaar	18.6.12	E.A.K.
1101/3	Prince William ..	W. R. Boys ..	Benalla ..	15.8.12	R.G.
1063/3	Prince William ..	J. and S. Knee ..	Quambatook ..	30.7.12	R.G.
1015/3	Real McKay ..	J. Patrick ..	New Zealand Exam.	1.6.12	..
1091/3	Redhill Chief ..	W. Howe ..	Inglewood ..	13.8.12	R.N.J.
906/3	Repeater	F. W. Sallmann ..	Dimboola (Special Parade)	2.7.12	E.A.K.
996/3	Robertson's Fancy	T. Mann ..	City Horse Bazaar	15.7.12	R.G.
1177/3	Robin's Pride ..	H. Cameron ..	Orbost	3.10.12	R.N.J.
1170/3	Roseneath King ..	J. Jamieson ..	Yarram ..	19.9.12	R.G.
1041/3	Royal Agitator ..	R. Wilson ..	Newmarket ..	23.7.12	R.N.J.
968/3	Royal Charlie ..	Le Court Bros. ..	Agricultural Offices	13.7.12	R.G.
1033/3	Royal Churchill ..	H. Wright ..	Newmarket ..	22.7.12	R.N.J.
894/3	Royal Escort ..	Capt. Stewart Balmain	City Horse Bazaar	18.6.12	R.G.
788/3	Royal Gartley ..	S. Knight ..	Warrnambool (Special Exam.)	28.10.12	R.G.
866/3	Royal Gem ..	R. J. Wakeham ..	Newmarket (Special)	17.6.12	E.A.K.
821/3	Royal King ..	F. D. Huff ..	Illowa (Special)	16.4.12	E.A.K.
1118/3	Royal Link ..	H. A. Jackson ..	Casterton ..	21.8.12	R.G.
1119/3	Royal Main ..	Stock Bros. ..	Casterton ..	21.8.12	R.G.
895/3	Royal McGregor ..	F. H. Dunne ..	City Horse Bazaar	18.6.12	R.G.
1156/3	Royal Palmer ..	P. McMiniman ..	Kyneton ..	10.9.12	R.N.J.
867/3	Royal Pride ..	W. P. Bowman ..	Newmarket (Special)	17.6.12	E.A.K.
1161/3	Royal Prince ..	Green Bros.	Ballarat ..	14.9.12	R.N.J.
915/3	Royal Robin ..	J. H. Hall ..	Horsham ..	2.7.12	R.N.J.
1046/3	Royal Salute ..	M. J. Ryan ..	New Zealand Exam.	14.6.12	..
839/3	Royal Salute ..	T. Opie ..	Newmarket (Special)	26.4.12	E.A.K.
935/3	Royal Sovereign ..	Caffrey and Murphy	City Horse Bazaar	15.7.12	R.N.J.
1157/3	Royal Sovereign ..	E. Bodey ..	Camperdown ..	11.9.12	E.A.K.
969/3	Royal Standard ..	H. S. Graham ..	Agricultural Offices	13.7.12	E.A.K.
1103/3	Royalty	H. Pearce ..	Dimboola ..	16.8.12	E.A.K.
840/3	Royal Wattle ..	J. Kavanagh ..	Newmarket (Special)	24.6.12	E.A.K.
849/3	Runnymede ..	F. W. Grigg ..	Newmarket (Special)	4.6.12	E.A.K.
1141/3	Sampson	Winter-Irving and Allison	Royal Show ..	2.9.12	R.G.
1040/3	Samson	V. C. Kurrle ..	Newmarket ..	23.7.12	R.N.J.
1034/3	Sandy Mac ..	R. Biggar ..	Newmarket ..	22.7.12	E.A.K.
1035/3	Sandy McNeil ..	E. Roberts ..	Newmarket ..	22.7.12	E.A.K.
1162/3	Scotchman ..	Strawhorn and Sons	Ballarat ..	14.9.12	R.N.J.
1178/3	Scotland	Nixon Bros. ..	Orbost	3.10.12	R.N.J.
1153/3	Scotland's Fancy ..	J. Holmes ..	Colac	13.9.12	E.A.K.
868/3	Scotland's Pride ..	J. R. MacKenzie	Newmarket (Special)	17.6.12	E.A.K.
1131/3	Scotland Yet ..	W. Gardner ..	Yea	29.8.12	E.A.K.
1095/3	Scottie	H. Schmidt ..	Kaniva	15.8.12	E.A.K.
1036/3	Scottish Model ..	H. McLaren ..	Newmarket ..	22.7.12	R.N.J.
1130/3	Seafield	J. Egan.. ..	Mansfield ..	29.8.12	E.A.K.
1092/3	Seddon's Pride ..	Parson Bros. ..	Elmore	9.8.12	E.A.K.
841/3	Shepherd Baldie ..	J. R. Henry ..	Newmarket (Special)	26.4.12	E.A.K.
1110/3	Shepherd's Pride ..	P. A. Ferrari ..	Nathalia ..	20.8.12	R.N.J.
1045/3	Shepherd Yet ..	O. Maroske ..	New Zealand Exam.	14.6.12	..
1123/3	Silver Style ..	H. Gibson ..	Rochester ..	20.8.12	E.A.K.

List of Terminable Certificated Stallions—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		Draughts—*continued.*			
1142/3	Sir Colin ..	McKenzie Bros.	Royal Show	2.9.12	R.G.
933/3	Sir Daniel	J. Drain	Agricultural Offices	13.7.12	R.N.J.
928/3	Sir Donald	H. W. E. Link	Horsham	3.7.12	R.N.J.
997/3	Sir Douglas	W. McGaffin	City Horse Bazaar	15.7.12	R.G.
925/3	Sir Edward	E. A. Rethus	Horsham	3.7.12	R.N.J.
949/3	Sir Norman's Fancy	R. Walton	Agricultural Offices	6.7.12	R.G.
1066/3	Sir Samuel	J. T. Collins	Bendigo (Special)	1.8.12	R.G.
1084/3	Sir Wilfred	A. J. Mackay	St. Arnaud	6.8.12	R.N.J.
1050/3	Sir William	J. Moffatt	New Zealand Exam.	1.6.12	.
934/3	Southland's Glory	P. L. Marum	Agricultural Offices	13.7.12	R.N.J.
1058/3	Speculation	J. Bodey	New Zealand Exam.	10.4.12	..
950/3	Springburn	A. L. Waddell	Agricultural Offices	6.7.12	R.G.
1111/3	Statesman	John Crane	Nathalia	20.8.12	R.N.J.
1120/3	Steel Link	C. Rhodes	Casterton	21.8.12	R.G.
1008/3	Stewart's Fancy	J. Christie	New Zealand Exam.	17.6.12	
1107/3	Superior ..	T. O'Brien	Cobram	23.8.12	R.N.J.
845/3	Superior Baron	T. Scott	Newmarket (Special)	1.5.12	E.A.K.
1037/3	Taieri Chief	J. Burns	Newmarket	22.7.12	R.G.
918/3	Taieri's Pride	W. Parish	Horsham	2.7.12	R.N.J.
1090/3	Tam McGregor	W. J. Hill	Inglewood	13.8.12	R.N.J.
1064/3	Tam McGregor	T. Walker	Boort	30.7.12	R.G.
905/3	Tarnacre Tom	W. Price-Jones	English Exam.	21.2.12	..
1143/3	The Baron	J. R. Glenn	Royal Show	2.9.12	R.G.
896/3	The Count..	Mitchell and O'Brien	City Horse Bazaar	18.6.12	R.G.
897/3	The Favourite	J. C. Rockliffe	City Horse Bazaar	18.6.12	E.A.K.
951/3	The Favourite	J. Denver	Agricultural Offices	6.7.12	R.G.
979/3	The General	J. W. Blair	New Zealand Exam.	30.5.12	.
898/3	The Knight	E. R. Morton	City Horse Bazaar	18.6.12	R.G.
941/3	The Laird	C. Falkenburg	Horsham	3.7.12	E.A.K.
1144/3	The Marquis	Young and Sons	Royal Show	2.9.12	R.N.J.
899/3	The Newton	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
1067/3	The Premier	A. Borland	Bendigo (Special)	1.8.12	R.G.
900/3	The Ranter	Mitchell and O'Brien	City Horse Bazaar	18.6.12	E.A.K.
1038/3	The Schoolmaster	W. McElligott	Newmarket	22.7.12	E.A.K.
942/3	The Settler	C. D. Urquhart	Horsham	3.7.12	E.A.K.
1112/3	The Stewart	A. Colvin	Nathalia	20.8.12	R.N.J.
820/3	The Vicar	T. Robson	English Exam.	1.3.12	.
904/3	Titch ..	W. Price-Jones	English Exam.	15.2.12	.
846/3	Titiroa Baron	Harkes Bros.	Newmarket (Special Exam.)	1.5.12	E.A.K.
1148/3	Tom McDonald	A. H. Davidson	New Zealand Exam.	13.5.12	..
1056/3	Trafalgar ..	J. Bodey	New Zealand Exam.	10.4.12	..
1098/3	True Blue	E. Fitzgerald	Geelong	13.8.12	E.A.K.
844/3	Tweedbank	D. Gardiner	Newmarket (Special)	26.4.12	E.A.K.
842/3	Tweed Boy	Robertson and Mackenzie	Newmarket (Special)	26.4.12	E.A.K.
1145/3	Twilight ..	R. N. Scott	Royal Show	2.9.12	R.N.J.
998/3	Ulimaroa ..	F. Jones	City Horse Bazaar	16.7.12	R.N.J.
960/3	Umberslade Blaze	W. Price-Jones	English Exam.	27.3.12	..
961/3	Umberslade Friar	W. Price-Jones	English Exam.	27.3.12	..
962/3	Umberslade Senator	W. Price-Jones	English Exam.	27.3.12	..
1125/3	Upward ..	Dunlop Bros.	Tatura ..	22.8.12	E.A.K.
1010/3	Waironga Duke	J. W. Blair	New Zealand Exam.	17.6.12	..
921/3	Warkworth's Pride	G. Harris	Horsham	2.7.12	R.N.J.
869/3	Wedderburn	J. H. Hall	Newmarket (Special)	17.6.12	E.A.K.
843/3	Wee McDougall	J. R. Henry	Newmarket (Special)	26.4.12	E.A.K.
1039/3	Wee McGregor	E. Roberts	Newmarket	22.7.12	E.A.K.
901/3	Wigtonshire	Burton Bros.	City Horse Bazaar	18.6.12	R.G.

List of Terminable Certificated Stallions—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		Draughts—*continued.*			
993/3	Willie Mac	Mitchell and O'Brien	City Horse Bazaar	16.7.12	R.N.J.
1165/3	Young Clyde	J. Harkins	Bacchus Marsh	14.9.12	R.G.
985/3	Young Dunsmore's Patriarch	J. Sullivan	City Horse Bazaar	16.7.12	E.A.K.
1163/3	Young Gladbrook	White Bros.	Ballarat	14.9.12	R.N.J.
1128/3	Young Jack	P. J. Quinlan	Shepparton	23.8.12	E.A.K.
1071/3	Young Lanark	Schultz Bros.	Warracknabeal	2.8.12	E.A.K.
1102/3	Young Lochinvar	J. Moodie	Benalla	15.8.12	R.G.
		LIGHT HORSES.			
1099/3	Abbey Isles	A. Habel	Minyip	8.8.12	R.G.
1093/3	All Kilts	G. Gibson	Myrtleford	14.8.12	R.G.
1183/3	Almont B.	R. Hutton	Agricultural Offices	9.10.12	R.N.J.
1152/3	Ariel	Boddy and Johnston	Whittlesea	9.9.12	R.N.J.
1158/3	Auburn Prince	S. McCartney	Ballarat	14.9.12	R.N.J.
1098/3	Belmont Bells	W. Day	Geelong	13.8.12	E.A.K.
1126/3	Brooderwood	C. R. Dunlop	Shepparton	23.8.12	E.A.K.
914/3	Charles Derby	A. Greig	Horsham	2.7.12	R.N.J.
1159/3	Cosmo	J. Burke	Ballarat	14.9.12	R.N.J.
1075/3	Dark Havelock	G. Plant	Pyramid	5.8.12	E.A.K.
1079/3	Elect	W. McDonald	Swan Hill	7.8.12	E.A.K.
1138/3	Emulous	G. Bourne	Royal Show	2.9.12	W.J.C.
1146/3	Galtrim	F. H. Fox	Sea Lake (Special)	29.8.12	G.H.
1054/3	Harry Almont	J. Douglas, jun.	Charlton	18.7.12	G.H.
1081/3	Honesty	J. O'Sullivan	Elmore	9.8.12	E.A.K.
1168/3	Micky Free	John Ellis	Warragul	12.9.12	E.A.K.
1147/3	Napoleon	A. McFarlane	Sea Lake (Special)	29.8.12	G.H.
1124/3	Patriarch	R. Dunbar	Tatura	22.8.12	E.A.K.
1174/3	Prince Royal	A. McDonald	Kilmore	26.9.12	R.G.
1184/3	Ribbonwood's Pride	J. S. Folland	Ballarat Show (Special Exam.)	14.11.12	E.A.K.
1097/3	Titanic	W. Day	Geelong	13.8.12	E.A.K.
1134/3	Young Majestic	J. Moroney	Yarrawonga	27.8.12	E.A.K.
		PONIES.			
1171/3	Ballyrogan	S. Sandwith	Ballan	26.9.12	E.A.K.
1159/3	Dandy Lad	Stuckey Bros.	Traralgon	11.9.12	R.G.
1185/3	Every Time	Anderson Bros.	Berwick (Special)	19.11.12	E.A.K.
990/3	Hauteur	R. V. Kelly	City Horse Bazaar	15.7.12	E.A.K.
1069/3	King Bee	W. T. McAlpine	Hopetoun	30.7.12	E.A.K.
1074/3	King Owyhee	M. Troy	Kerang	9.8.12	E.A.K.
1186/3	Silverton	D. McDonald	Camperdown (Special)	28.11.12	E.A.K.
1187/3	Starlight	W. Inglis	Agricultural Offices	3.12.12	E.A.K.
1175/3	Young Deisha	M. Deering	Morwell	1.10.12	R.N.J.

(Two-year-old Certificates expiring 30th June, 1913.)

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS.			
183/2	Argyle	R. McKenzie	Warracknabeal	2.8.12	E.A.K.
197/2	Baron McKie	Paterson Bros.	Romsey	16.9.12	E.A.K.
189/2	Baron's Own	F. M. Clement	Euroa	16.8.12	R.G.
191/2	Bay Rock	A. Mitchell	Casterton	21.8.12	R.G.
163/2	Bonny Boy	O. Bodey	Horsham	3.7.12	E.A.K.
165/2	Brown Boy	O. Warke	Horsham	3.7.12	R.N.J.
164/2	Brown Cashier	A. and J. Young	Horsham	2.7.12	R.N.J.
184/2	Cedric	K. Cameron	Warracknabeal	2.8.12	E.A.K.
199/2	Commodale Lad	W. Smith	Smeaton	12.9.12	R.N.J.
166/2	Clydebank	Nuske Bros.	Horsham	3.7.12	E.A.K.
181/2	Clyde Boy	J. Little	Boulah	1.8.12	E.A.K.
203/2	Crown Jewel	W. Buckley	Morwell	1.10.12	R.N.J.
167/2	Crown Top	O. Maroske	Horsham	2.7.12	R.N.J.
179/2	Dunsmore Nigger	J. Henry	Newmarket	22.7.12	E.A.K.
177/2	Explosive	Parish and Huf	Horsham	2.7.12	R.N.J.
202/2	Fine View Tenant	R. W. Laidlaw	Beaufort	27.9.12	E.A.K.

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
		DRAUGHTS—*continued.*			
204/2	General	H. McNab	Morwell	1.10.12	R.N.J.
168/2	Herd Lad	H. Walsgott	Horsham	2.7.12	R.N.J.
160/2	Johnny Souter	Parish and Huf	Horsham	2.7.12	R.N.J.
192/2	King Marshall	Baker Bros.	Rutherglen	26.8.12	E.A.K.
194/2	Lochinvar	W. R. Clarke	Royal Show	2.9.12	R.G.
170/2	Locksley	O. Maroske	Horsham	3.7.12	E.A.K.
200/2	Lord Ailsa	J. Jamieson	Yarram	19.9.12	R.G.
171/2	Lord Cashier	A. and J. Young	Horsham	2.7.12	R.N.J.
172/2	Minoru	H. Young	Horsham	2.7.12	R.N.J.
190/2	Percy II.	J. McFarlane	Hamilton	22.8.12	R.G.
205/2	Prince Aldie	Brock Bros.	Morwell.	1.10.12	R.N.J.
195/2	Prince Charlie	Pedretti Bros.	Daylesford	13.9.12	R.N.J.
193/2	Prince Edward	King and Sons	Rutherglen	26.8.12	E.A.K.
188/2	Prince George	M. Bodey	Nhill	14.8.12	E.A.K.
182/2	Prince Royal	Jas. Little	Beulah	1.8.12	E.A.K.
201/2	Professor	J. Egan	Ballan	26.9.12	E.A.K.
173/2	Ringmaster	D. McDonald	Horsham	3.7.12	R.N.J.
174/2	Robert Cashier	A. and J. Young.	Horsham	2.7.12	R.N.J.
160/2	Royal Blend	F. W. Borgelt	Illowa (Special)	16.4.12	E.A.K.
178/2	Royal Dick	M. Ewart	City Horse Bazaar	16.7.12	R.G.
198/2	Royal Ettrick	J. Egan	Warrnambool	12.9.12	E.A.K.
206/2	Royal Plumpton	H. Hall	Agricultural Offices	1.3.13	R.N.J.
162/2	Royal Prince	J. Gooden	Illowa (Special)	16.4.12	E.A.K.
161/2	Royal Saxon	R. Grafter	Illowa (Special)	16.4.12	E.A.K.
159/2	Royal Title	R. W. Dunne	Illowa (Special)	16.4.12	E.A.K.
175/2	Ruskin	Parish and Huf	Horsham	2.7.12	R.N.J.
187/2	Shepherd	Geelong Harbour Trust	Geelong	13.8.12	E.A.K.
176/2	Shepherd Oak	E. Wahlenburg	Horsham	2.7.12	R.N.J.
180/2	Sir Lawrence	H. Knight	Newmarket	22.7.12	E.A.K.
186/2	Warrego	J. F. Pinn	Myrtleford	14.8.12	R.G.
185/2	Young Lochiel	H. Lee	Clunes	14.8.12	R.N.J.
		PONIES.			
196/2	Constellation	Gooden Bros.	Port Fairy	10.9.12	E.A.K.

STALLION PARADES, 1913.

TIME TABLE.

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
SPECIAL.				
14th to 19th July ..	City Horse Bazaar	10. a.m.		
21st to 25th July ..	Newmarket Horse Bazaar	10 a.m.		
Every Saturday, 28th June to 13th December	Agricultural Offices	10 a.m. to 12 noon		
WIMMERA No. 1.				
1st and 2nd July ..	Horsham ..	10 a.m. ..	11.59 p.m. (30th June)	2.54 a.m. (3rd)
CENTRAL No. 1.				
Thursday, 24th July	Bendigo ..	1.30 p.m.	11.20 a.m. ..	3.15 p.m.
MALLEE No. 1.				
Tuesday, 29th July ..	Quambatook	9.30 a.m.	6.35 p.m. (28th)	10.47 a.m
Tuesday, 29th July ..	Boort ..	3 p.m. ..	12.20 p.m. ..	6.10 a.m. (30th)
Wednesday, 30th July	Charlton ..	2 p.m. ..	9.17 a.m. ..	4.28 p.m.
Thursday, 31st July	Sea Lake ..	2 p.m. ..	9.55 p.m. (30th)	6.40 a.m. (1st Aug.)
Friday, 1st Aug. ..	Wycheproof	10 a.m. ..	10 a.m. ..	11.20 a.m.
WIMMERA No. 2.				
Tuesday, 29th July ..	Hopetoun ..	10.15 a.m.	10.15 a.m. ..	11.20 a.m.
Wednesday, 30th July	Murtoa ..	2 p.m. ..	12.50 p.m. (29th)	6.20 p.m.
Thursday, 31st July	Beulah ..	10.30 a.m.	10.10 p.m. (30th)	12.40 p.m.
Friday, 1st Aug. ..	Warracknabeal	1.30 p.m.	2.25 p.m. (31st)	2.55. p.m.
WIMMERA No. 3.				
Wednesday, 30th July	Goroke ..	3.30 p.m.	2.20 p.m. ..	6.30 a.m. (31st)
Thursday, 31st July	Edenhope ..	3 p.m. ..	12 noon ..	1.30 p.m. (1st Aug.)
WIMMERA No. 4.				
Tuesday, 5th Aug. ..	Balmoral ..	3 p.m. ..	11.30 a.m. ..	11 a.m. (6th)
Thursday, 7th Aug. ..	Minyip ..	2 p.m. ..	6.53 a.m. ..	4.8 p.m.

STALLION PARADES, TIME TABLE—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
MALLEE No. 2.				
Monday, 4th Aug. ..	Heathcote ..	2 p.m. ..	11.41 a.m. ..	8.17 p.m.
Tuesday, 5th Aug. ..	St. Arnaud	3.30 p.m.	3.22 p.m.	9.42 p.m.
Wednesday, 6th Aug.	Donald ..	2 p.m. ..	10.52 p.m. (5th)	6 p.m.
Thursday, 7th Aug. ..	Watchem ..	2 p.m. ..	7.27 p.m. (6th)	7.10 p.m.
Friday, 8th Aug. ..	Birchip ..	3 p.m. ..	7.45 p.m. (7th)	2.55 a.m. (9th)
NORTH-EASTERN No. 1.				
Monday, 4th Aug. ..	Rutherglen	2 p.m. ..	1.48 p.m. ..	3.22 p.m.
Tuesday, 5th Aug. ..	Yarrawonga	11 a.m. ..	10.22 p.m. ..	2.45 p.m.
Tuesday, 5th Aug. ..	Tungamah ..	3.45 p.m.	3.28 p.m. ..	7.45 a.m. (6th)
Wednesday, 6th Aug.	Myrtleford ..	3 p.m. ..	2.54 p.m. ..	7.17 a.m. (7th)
Thursday, 7th Aug. ..	Wangaratta	2 p.m. ..	9.16 a.m. ..	4.37 p.m.
Friday, 8th Aug. ..	Benalla ..	2 p.m. ..	5.23 p.m. (7th)	5 35 p.m.
NORTH-EASTERN No. 2.				
Monday, 11th Aug. ..	Euroa ..	3 p.m. ..	10.24 a.m. ..	6.32 p.m.
Tuesday, 12th Aug. .	Seymour ..	10 a.m. ..	7.59 p.m. (11th)	12.15 p.m.
Wednesday, 13th Aug.	Dimboola ..	3 p.m. ..	12.42 a.m. ..	2.18 a.m. (14th)
Thursday, 14th Aug.	Beaufort ..	3 p.m. ..	6.31 a.m. ..	5.28 p.m.
Friday, 15th Aug. ..	Frankston ..	3 p.m. ..	2.38 p.m. ..	5.50 p.m.
MALLEE No. 5.				
Monday, 11th Aug. ..	Pyramid ..	3 p.m. ..	2.36 p.m. ..	2.36 p.m. (12th)
Wednesday, 13th Aug.	Swan Hill ..	2 p.m ..	6 16 p.m. (12th)	11 a.m. (14th)
Thursday, 14th Aug.	Kerang ..	2 p.m. ..	12.39 p.m. ..	6 a.m. (15th)
Friday, 15th Aug. ..	Elmore ..	2 p.m. ..	1.11 p.m. ..	5.22 p.m.
NORTH-EASTERN No. 3.				
Monday, 11th Aug. ..	Dookie ..	2 p.m. ..	12.52 p.m. ..	4.11 p.m.
Tuesday, 12th Aug.	Nathalia ..	2 p.m. ..	1.40 p.m. ..	3.25 p.m.
Wednesday, 13th Aug.	Numurkah	2 p.m. ..	4.10 p.m. (12th)	4.43 p.m.
Thursday, 14th Aug.	Murchison ..	9.30 a.m.	6.53 p.m. (13th)	10.58 a.m.
Thursday, 14th Aug.	Rushworth	2 p.m. ..	11.48 a.m. ..	5.20 p.m.
Friday, 15th Aug. ..	Cobram ..	2 p.m. ..	1.57 p.m. ..	3.10 p.m.
WESTERN No. 1.				
Monday, 18th Aug. ..	Ararat ..	3 p.m. ..	1.29 p.m. ..	7.15 a.m. (19th)
Tuesday, 19th Aug. ..	Hamilton ..	2 p.m. ..	9.55 a.m. ..	6.20 p.m.
Wednesday, 20th Aug.	Coleraine ..	10 a.m. ..	7.35 p.m. (19th)	11 a.m. (Driving)
Wednesday, 20th Aug	Casterton ..	3 p.m. ..	1 p.m. (Driving)	8.15 a.m. (21st)
Thursday, 21st Aug.	Portland ..	2 p.m. ..	1.2 p.m. ..	3 p.m.
Friday, 22nd Aug. ..	Penshurst ..	2 p.m. ..	7.10 p.m. (21st)	5.4 p.m.

STALLION PARADES, TIME TABLE—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
GOULBURN VALLEY No. 1.				
Monday, 18th Aug. ..	Castlemaine	2 p.m. ..	10.20 a.m. ..	10.32 a.m. (19th)
Tuesday, 19th Aug.	Rochester ..	2 p.m. ..	1.36 p.m. ..	9.57 p.m.
Wednesday, 20th Aug.	Echuca ..	1 p.m. ..	10.23 p.m. (19th)	2.55 p.m.
Thursday, 21st Aug.	Tatura ..	10 a.m. ..	5.36 p.m. (20th)	11.42 a.m.
Thursday, 21st Aug.	Kyabram ..	2 p.m. ..	12.50 p.m. ..	4.20 p.m.
Friday, 22nd Aug. ..	Shepparton..	1 p.m. ..	8.23 p.m. (21st)	5.49 p.m.
WIMMERA No. 5.				
Monday, 18th Aug. ..	Melton ..	11 a.m. ..	8.41 a.m ..	1.21 p m.
Tuesday, 19th Aug. ..	Geelong ..	2 p.m. ..	12.49 p.m. ..	5.25 p.m.
Wednesday, 20th Aug.	Nhill ..	2 p.m. ..	1.31 a.m. ..	7.30 a.m. (21st)
Thursday, 21st Aug.	Kaniva ..	2 p.m. ..	8.50 a.m. ..	5.52 a.m. (22nd)
Friday, 22nd Aug. ..	Jeparit ..	2 p.m. ..	11.33 a.m. ..	9.53 p.m.
CENTRAL No. 2.				
Monday, 25th Aug. ..	Stawell ..	3 p.m. ..	2.38 p.m ..	10.13 p.m.
Tuesday, 26th Aug. ..	Rainbow ..	3 p.m. ..	1.25 p.m ..	8 p.m.
Wednesday, 27th Aug.	Maryborough	2 p.m. ..	10.5 a.m. ..	6.5 a.m. (28th)
Thursday, 28th Aug.	Inglewood ..	11 a.m. ..	8.40 a.m. ..	2.10 p.m.
Thursday, 28th Aug.	Dunolly ..	4 p.m. ..	3.50 p.m. ..	9.17 a.m. (29th)
Friday, 29th Aug. ..	Clunes ..	2 p.m. ..	1.42 p.m. ..	3 p.m.
NORTH-EASTERN No. 4.				
Monday, 25th Aug. ..	Alexandra ..	2 p.m. ..	12.45 p.m. ..	4.40 p.m.
Tuesday, 26th Aug.	Yea ..	9.30 a.m.	6.23 p.m. (25th)	10.35 a.m.
Tuesday, 26th Aug.	Mansfield ..	2 p.m. ..	1.50 p.m. ..	3.30 p.m.
Thursday, 28th Aug.	Mildura ..	2 p.m. ..	8 40 a.m. ..	6.30 a.m. (29th)
WESTERN No. 2.				
Monday, 25th Aug. ..	Terang ..	2 p.m. ..	12.44 p.m. ..	9.53 p.m.
Tuesday, 26th Aug. ..	Port Fairy ..	2 p.m. ..	12.19 a.m. ..	5.45 a.m. (27th)
Wednesday, 27th Aug.	Camperdown	2 p.m. ..	8.46 a.m. ..	9.18 p.m.
Thursday, 28th Aug.	Warrnambool	2 p.m. ..	10.58 p.m. ..	7.11 a.m. (29th)
Friday, 29th Aug. ..	Colac ..	2 p.m. ..	10.9 a.m. ..	6.59 p.m.
Saturday, 30th Aug.	Werribee ..	10 a.m. ..	9.58 p.m. ..	1.34 p.m.
GIPPSLAND No. 1.				
Monday, 1st Sept. ..	Mirboo ..	2 p.m. ..	1.50 p.m. ..	4.15 p.m.
Tuesday, 2nd Sept. ..	Morwell ..	10 a.m. ..	5.55 p.m. (1st)	11.57 a.m.
Tuesday, 2nd Sept. ..	Traralgon ..	2 p.m. ..	12.10 p.m. ..	12.20 p.m. (3rd)
Wednesday, 3rd Sept.	Bairnsdale ..	3.30 p.m.	3.25 p.m. ..	5.40 a.m. (4th)
Thursday, 4th Sept.	Maffra ..	2 p.m. ..	7.14 a.m. ..	7.18 a.m.
Friday, 5th Sept. ..	Bunyip ..	2 p.m. ..	11.25 a.m. ..	4.26 p.m.

STALLION PARADES, TIME TABLE—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
GIPPSLAND No. 2.				
Monday, 1st Sept. ..	Foster ..	12.45 p.m.	12.38 p.m. ..	2.21 p.m.
Monday, 1st Sept. ..	Leongatha ..	4 p.m. ..	3.56 p.m. ..	7.25 a.m. (2nd)
Tuesday, 2nd Sept. ..	Lang Lang	3 p.m. ..	9.25 a.m. ..	7.26 p.m.
Wednesday, 3rd Sept.	Korumburra	11 a.m. ..	8.30 p.m. (2nd)	10.42 a.m. (4th)
Thursday, 3rd Sept.	Yarram ..	4 p.m. ..	3.45 p.m. ..	10.55 a.m. (5th)
GIPPSLAND No. 3.				
Monday, 1st Sept. ..	South Yan Yean	2 p.m. ..	12.24 p.m. ..	8.23 p.m.
Tuesday, 2nd Sept. ..	Lilydale ..	2 p.m. ..	1.34 p.m. ..	5.35 p.m.
Wednesday, 3rd Sept.	Dandenong	3 p.m. ..	2.27 p.m. ..	5.21 p.m.
Thursday, 4th Sept.	Trafalgar ..	11 a.m. ..	8.8 p.m. (3rd) ..	2.20 p.m.
Thursday, 4th Sept.	Warragul ..	3 p.m. ..	3 p.m. ..	10.57 a.m.
Friday, 5th Sept. ..	Berwick ..	2 p.m. ..	12.16 p.m. ..	5.24 p.m.
CENTRAL No. 3.				
Monday, 8th Sept. ..	Romsey ..	2 p.m. ..	10.10 a.m. ..	5.25 p.m.
Tuesday, 9th Sept. ..	Kyneton ..	2 p.m. ..	8.21 p.m. (8th)	8.32 p.m. (10th)
Wednesday, 10th Sept.	Daylesford ..	2 p.m. ..	11.59 a.m. ..	7.8 a.m. (11th)
Thursday, 11th Sept.	Smeaton ..	2 p.m. ..	9.20 a.m. ..	4.30 p.m.
Friday, 12th Sept. ..	Ballan ..	2 p.m. ..	8.21 p.m. (11th)	6.33 p.m.
Saturday, 13th Sept.	Ballarat ..	2 p.m. ..	7.23 p.m. (12th)	7.10 p.m.
NORTH-EASTERN No. 5.				
Monday, 8th Sept. ..	Wodonga ..	2 p.m. ..	1.39 p.m. ..	3.15 p.m.
Tuesday, 9th Sept. ..	Tallangatta	2 p.m. ..	4.36 p.m. (8th)	5 a.m. (10th)
Wednesday, 10th Sept.	Corryong ..	3.30 p.m.	3.30 p.m. ..	7 a.m. (11th)
CENTRAL No. 4.				
Wednesday, 17th Sept.	Bacchus Marsh	11 a.m. ..	9 a.m. ..	12.59 p.m.
Thursday, 18th Sept.	Kilmore ..	2 p.m. ..	9.8 a.m. ..	8.40 p.m.
Saturday, 20th Sept	Royal Show Grounds	9 a.m. to 11 a.m.		
Wednesday, 8th Oct.	Omeo ..	3 p.m. ..	6.30 p.m. (7th)	6.30 a.m. (9th)
Tuesday, 7th Oct. ..	Orbost ..	3 p.m. ..	2 p.m. ..	8.2 a.m. (10th)

ALKALI IN SOILS.

By John W. Paterson, B.Sc., Ph.D.

Introduction.

The main bulk of a soil is insoluble in water. But a soil always contains a certain quantity of soluble salts. With no soluble salts a soil would be infertile. At times, however, a soil may contain an excess of soluble salts, and such excess is injurious to vegetation. A sure method of clearing a pathway from weeds is to apply a heavy sprinkling of common salt.

The soluble salts naturally present in soils may be of different kinds. A mixture is always present. This includes chlorides, sulphates, nitrates, and sometimes carbonates of potash, soda, magnesia, and lime. The proportions in which the various constituents are present depends chiefly upon the chemical character of the soil minerals and the physical condition of the subsoil.

Origin of Soluble Salts.

The soluble salts present in soils have two sources of origin. One of these is the soil itself. The insoluble mineral matters, also the humus bodies in the soil, slowly undergo chemical change as a result of "weathering" agencies. Some of those changes yield soluble products. Soluble salts are also directly added to the soil in rain water. Thus, at Rothamsted (England), 24 lbs. of common salt and 31 lbs. of sulphate of soda were obtained annually per acre through rain; at Canterbury (N.Z.) the corresponding figures were 98 and 26. Observations at other places* show that rain always supplies soluble salts, and at maritime stations the amounts quoted may be largely exceeded.

Where the Salts Accumulate.

From the soil itself, therefore, and from the rain the soluble salts receive constant additions. Whether in any particular soil the actual amount will increase depends upon whether or not the annual gains exceed the annual losses. With good drainage and sufficient rainfall, any excess of soluble salts is soon washed away. In districts with a small rainfall or bad natural drainage all the soluble salts added tend to accumulate. Generally speaking, excess of soluble salts is an evil which is confined to arid and semi-arid districts.

In a humid region the best soils produce soluble salts freely, including those required for plant growth. That is why they are good, and any excess of salts is washed away in drainage. In dry districts the best soils also produce soluble salts freely, but here the excess may not get washed away. As a result we find that excess of salts is not only characteristic of arid districts, but also that where it occurs in arid districts it occurs most commonly on the better classes of land.

What is Alkali?

A soil may become infertile owing to an undue accumulation of soluble salts. Such excess of salts represents an old trouble in

* Jour. Agri. Sci. Vol. I. Pt. 3

America, India, Egypt, and the dry countries of the world. When present in amount sufficient to injure vegetation, the soluble salts are generally referred to as soil "alkali." The word is here used in an agricultural and not in the chemical sense.

There are two kinds of "alkali"—black and white. Black alkali is chiefly the carbonate of soda (washing soda). White alkali includes all the other salts, but sodium chloride (common salt) and sodium sulphate (Glauber's salt) usually predominate. The white alkali may also include soluble salts of magnesia and lime.

Black Alkali.

Of the two kinds of alkali, black alkali is the worst as regards its effect on plants, but when present in moderate quantity is capable of remedy by simpler means than in the case of white alkali. Being carbonate of soda, black alkali has a strongly corrosive action on the tender rootlets of plants and destroys these. It may also hinder and stop nitrification by making the soil too alkaline. It also has a bad

FIG 1.—WHEAT GROWING 3 FEET HIGH AFTER TREATING BLACK ALKALI WITH GYPSUM.

effect on the physical condition of the soil by causing clay to become pasty and run together. Washing soda colours the moist humus matters of the soil black, and hence the name "black" alkali.

Use of Gypsum.

The evils of black alkali may often be removed by applying gypsum. Gypsum is sulphate of lime. With carbonate of soda the sulphate of lime reacts, giving, by double decomposition, sulphate of soda and carbonate of lime. The latter is insoluble, and of benefit to land. The sulphate of soda is much less harmful than the carbonate of soda, because it is a neutral salt and has no corrosive effect on the crop roots. According to Hilgard and Loughridge,* barley can resist about five

* Univ. of Cal. Agri. Exp. Stn. Bul. 133.

times more of the sulphate than of the carbonate of soda in the soil. Fig. 1, by the same authors, shows how in California gypsum enabled a "barren black alkali spot" to grow wheat successfully.

To decompose 0.10 per cent. of sodium carbonate in the top foot of a soil about 2.8 tons of gypsum is required per acre, but Loughridge found that twice the chemical equivalent was necessary to get satisfactory work. Besides decomposing the black alkali, gypsum renders soils more pervious to water soakage and facilitates the natural drainage. In bad cases of black alkali artificial drainage is necessary in addition to the use of gypsum.

White Alkali.

White alkali may also entirely destroy vegetation. Here the chloride and sulphate of soda have no corrosive action, but they hinder the crop in absorbing moisture from the soil. They further exert a pathological action upon the plants, as seen in the blackening and curling of the leaves in fruit trees. Excess of white alkali also

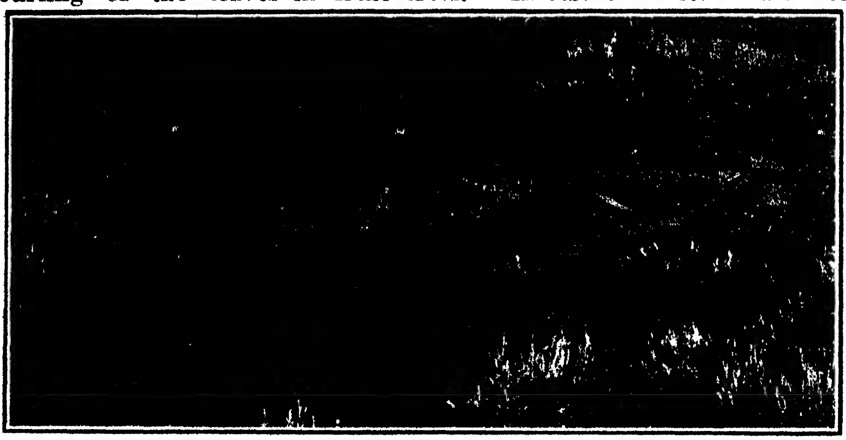


FIG. 2.—EVERYTHING KILLED OFF BUT THE SALT-BUSH.

hinders nitrification,* but it has not the injurious binding effect of black alkali upon clay soils. It leaves them powdery and friable. According to the authorities quoted above, the chloride of sodium is about twice as injurious as the sulphate when both are present in excess.

Gypsum is of no effect in removing the effects of white alkali, even when common salt is the chief constituent, and, indeed, on white alkali, the use of gypsum does harm by adding to the excess of soluble salts already present. Gypsum itself dissolves, if slowly, and nothing can be applied which will render white alkali harmless when the salts are present in amounts exceeding the tolerance of crops.

Salt-bush and Alkali.

A danger signal as to the probable occurrence of white alkali in a soil is frequently held out by the native vegetation. The various salt bushes (*Atriplex*) indigenous to Australia indeed thrive well on alkali soils even when the ordinary herbage is destroyed. Fig. 2

* Jour. Dep. Agri. Vic. July 1912.

represents a typical growth on a bad piece of unreclaimed alkali land in Victoria.

Dangerous Amounts of Alkali.

Exactly how much alkali will render a soil infertile has been the subject of considerable research. For black alkali, the United States Bureau of Soils* has adopted Hilgard's value of 0.1 per cent. as being the maximum that crops will stand. For white alkali, greater amounts are tolerated, and Means and Gardner† state "that in the soils of the Rosswell area, lucerne was just able to grow when the amount of salts was 0.4 to 0.5 per cent., and that 0.5 per cent. is taken as the maximum limit." Others set a different limit, due to the different conditions under which their researches were carried out. The following figures show the percentage of soluble salts found at different places in Victoria on spots where the crop was destroyed by alkali, and also for each crop from adjacent spots on the same field where the crop was doing well. The alkali was of the white variety in each case, being chlorides and sulphates. The percentages refer to the top foot of soil—

Alkali Soils in Victoria.

(*a*) CURRANT VINES.

	Vines doing Well.	Vines Killed.
Percentage of soluble salts	·018	2·061

(*b*) AMBER CANE.

	Crop Good.	Crop Killed.
Percentage of soluble salts	·036	2·108

(*c*) MAIZE.

	Crop Good.	Crop Killed.
Percentage of soluble salts	·028	1·903

(*d*) AMBER CANE.

	Crop partly Blighted.	Crop Killed.
Percentage of soluble salts	·186	·238

Circumstances Influencing Alkali Damage.

The fact seems to be that no definite standard can be laid down as to when a soil has too much alkali to grow a crop. It is safe, however, to accept the following generalizations:—

(*a*) *The Kind of Alkali.*—Sodium carbonate is more injurious than the chloride, and the chloride than the sulphate.

(*b*) *Its Vertical Distribution.*—The salts are most harmful when present in the upper layers of soil.‡

(*c*) *The Nature of the Soil.*—The same amount of alkali is more injurious in clay than in loamy soils, in which the roots can penetrate more freely.

(*d*) *The Kind of Crop.*—Most fruit trees suffer severely, but the fig, olive, and pear, in the order named, are very resistant to all kinds of alkali. Figs will often be seen healthy where other fruit trees have died out. According to Mackie§ grape vines are very sensitive, but some American resistant stocks show marked tolerance. He states

* U.S.D.A. Bureau of Soils. Rep. No. 64. † Univ. of Cal. Agri. Exp. Sta. Bul. 133.
‡ Loughridge, *loc. cit.* § U.S.D.A. Bureau of Soils Bul. 42

that "where alkali kills out spots in a vineyard, lucerne is usually planted, and where soils are too heavily charged with alkali to grow good lucerne, wheat and barley are grown. Barley is the most resistant of the cereals except, perhaps, rice. When the alkali is too strong for barley it is planted to Bermuda grass . . . its feeding roots have been found 9 feet deep, thus making it also drought-resistant. It should never be planted except in hopelessly ruined soils." Mangels and sugar beet are fairly resistant.

(*e*) *The Age of the Crop.*—Crops generally are much more susceptible when young, but when older, and the roots have penetrated more deeply, they are much more tolerant. American investigations with lucerne show that an established crop exceeds in tolerance a young crop of lucerne "to an extent almost beyond belief."

The Effect of Water.

As the various factors mentioned have each a bearing upon the question of whether a soil contains too much alkali to grow a crop, it

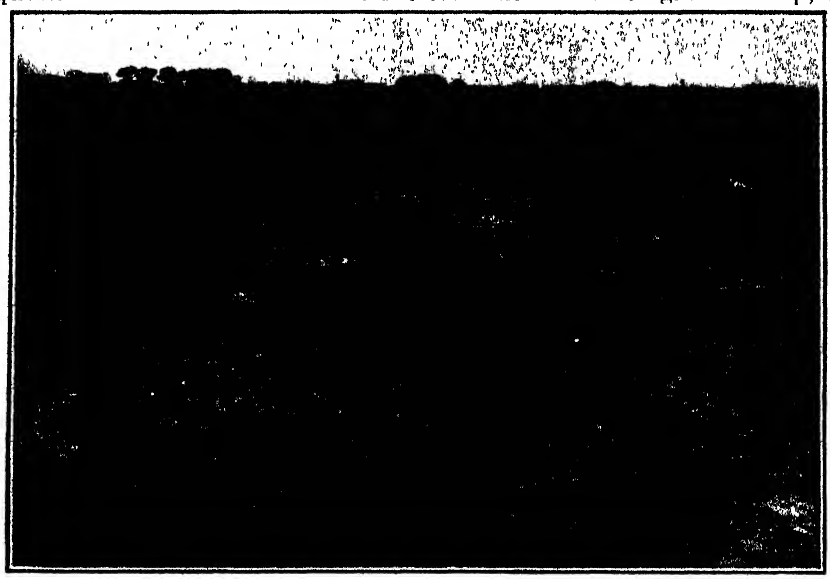


FIG. 3.—LUCERNE ATTACKED BY WHITE ALKALI (VICTORIA).

is obviously impossible to state any definite limit as to the amount of alkali which will cause infertility. What is an injurious amount of alkali varies according to circumstances. There is another important factor. Consideration of the manner in which alkali affects a crop indicates that it is less the percentage of alkali in the soil than the percentage in the soil water that is important. This view is strengthened when we reflect that in soils of moderate alkali content the injurious effect of the salt may be temporarily removed by a good fall of rain or by irrigation, as thereby the concentration of the salt in the soil water is diminished; by a good supply of water it may easily be diminished by one-half.

A crop on alkali land may show the effects of drought, and yet on turning the soil up it may seem wet enough. Some good examples of

this were observed during a recent visit to Mildura. The reason is that while crops require moisture on any soil, they require more than usual if the soil contains much alkali. There is, however, an early limit to the extent to which water, as in irrigation, can be used to mitigate the evil effects of alkali salts. It may be necessary to keep the soil so moist with this object that the excess of water leads to other evils. These are the evils which are characteristic of land that is swampy and sour, and which are well enough understood.

Movement of Alkali in Soils.

The laws which govern the movement of alkali within the soil are important, because it is upon a knowledge of these that rational methods of combating the evil must be based.

Height of the Water Table.

A common term in connexion with soil drainage is the "water table." This is the level to which at any time water would rise in a hole left open at the place. In some soils the water table, or ground water, would be located—if at all—only at great depths. In other cases, including on cultivated land, it would often be found, and especially in winter, within a few feet, or even inches, of the surface; and, indeed, the surface of the ground might be wholly submerged. Generally speaking, heavy rains and irrigation raise the water table in soils. The height of the water table is also subject to the influence of underground drifts, and it may rise very unequally at different parts in the same field. When within a few feet of the surface, water rises freely by capillarity from the water table to the surface, where it is dissipated by evaporation.

Ascent by Capillarity.

When sea water is evaporated down in a kettle the salts in it are left behind. When the water rising from the water table by capillarity is salty, evaporation at the surface causes the salts to be left there. The amount of water so evaporated will be greater the nearer the water table is to the surface. It will also be greater if the surface is caked, as is well known to farmers who work their fallows to diminish evaporation. The amount of water evaporated from the actual ground surface will also be greater on land not growing a crop. In alkali soils, therefore, a high water table and a baked surface free from vegetation are conditions which favour the carriage of salt to the surface. In bad cases the salt appears as a white incrustation.

Incrustations of Salt.

White incrustations of salt may also appear on the surface during the summer months on soils where the water table is low. This will only occur in arid districts. The effect of winter rains is to wash the salts down a few feet, and then as the soil dries out from the top again the salts re-ascend to the surface. In such cases the incrustations will usually be more uniformly distributed and show less disposition to aggregate in spots than in localities where, owing to irrigation, a well-defined water table has been formed.

Seasonal Movements.

Whether in alkali soils the greatest amount of alkali will be found in the top foot or at greater depths depends upon the season of the year, as this affects rainfall and evaporation. As a rule the alkali will move upwards in summer and downwards in winter, and the alkali content of the surface foot will be least in the early spring.

It has been previously observed that alkali is most injurious to crops when present near the surface of the ground. In combating the trouble, therefore, effort must be directed towards getting the salts down from the surface, and then keeping them down.

REMEDIAL MEASURES.

For practical purposes it can be said that the means to be adopted towards this end will depend upon the height of the water table.

Land with Good Drainage.

First.—When the Water Table is Low.—The means to be adopted will largely suggest themselves from what has already been said. On

FIG. 4—EFFECT OF ALKALI ON VINES, MILDURA.

unirrigated land, spring offers the best opportunity for seeding a young crop—following upon the downward leaching of winter rains. If the land can be irrigated, a good flooding will carry most of the salts downward, and thus give the young crop a proper chance to start. In either case, subsequent cultivation or intertillage is of great use in hindering a rapid re-ascent of the salt. Again, previous to seeding, deep ploughing will often be useful on good land in burying the salt, while at the same time it forms a soil mulch which impedes the rise of salt to the surface. In all cases on undrained land care must be exercised in order to avoid use of too much irrigation water, as thereby the

water table may be raised within the danger limit. Orchardists of experience and repute working on alkali soils at Mildura and Cohuna ascribe their success to a limited use of irrigation water, coupled with constant cultivation between the rows of trees. Where their methods fail in practice, as occasionally happens, it is on ground where the soil is deficient in natural drainage.

Benefit of a Growing Crop.

On land which is near the border line between success and failure owing to alkali, it is well worth while to devote extra care in order to get a crop once established. It has been noted that, *e.g.*, young lucerne was much less resistant than old lucerne. The reason is, doubtless, in part due to the greater toughness in the epidermis of older roots, and also to the greater depth to which the old roots penetrate, but it is also due in large measure to the water requirements of the growing crop. The roots absorb water throughout the whole body of soil to a depth of several feet, and in so doing they check at the points of absorption the ascent of alkali salts which in uncropped soil would eventually reach the surface. The crop foliage also limits evaporation by shading the surface. In these ways a growing crop tends to keep the alkali down, while the absence of crop increases the difficulty of cropping, and aggravates the evil.

Effect of Manures.

Ordinary artificial manures have no effect in destroying alkali, and, indeed, those of them which are water soluble have a prejudicial effect physically. They may, however, by giving stronger plants render them physiologically better able to withstand excess of alkali, and as Professor Watt, of Sydney,* recently demonstrated, the use of phosphates will specially cause the roots of crops to go deeper in the soil. This extra depth of roots is an advantage, as the most harmful effect of alkali is exerted near the surface. Among manures, the one most likely to materially aid the crop is a good dressing of stable manure incorporated with the surface soil. By loosening the soil this will impede the rise of salt, and by its well known power of increasing the water-holding power of soils the concentration of the salt solution in the surface layers will be correspondingly diminshed. Attention has been drawn† to the beneficial action of stable manure on small holdings in Salt Lake Valley.

Land with Bad Drainage.

Second.—Where the Water Table is High.—Where the ground water comes too near the surface in alkali soils ordinary cultivation methods and precautions are surrounded by difficulty, and may be fruitless of result. If the salt cannot be kept down sufficiently by cultivation and cropping, the only alternative left is to get rid of it altogether. For this purpose under-drainage is necessary. Fig. 5 shows a 12-acre paddock at Cohuna where a crop of oats failed owing to alkali, and which the owner now proposes to drain. The land has not been cultivated since the crop died off.

---

* Paper read at Science Congress, Melbourne, 1913.
† U.S.D.A. Bureau of Soils Bul. No. 43.

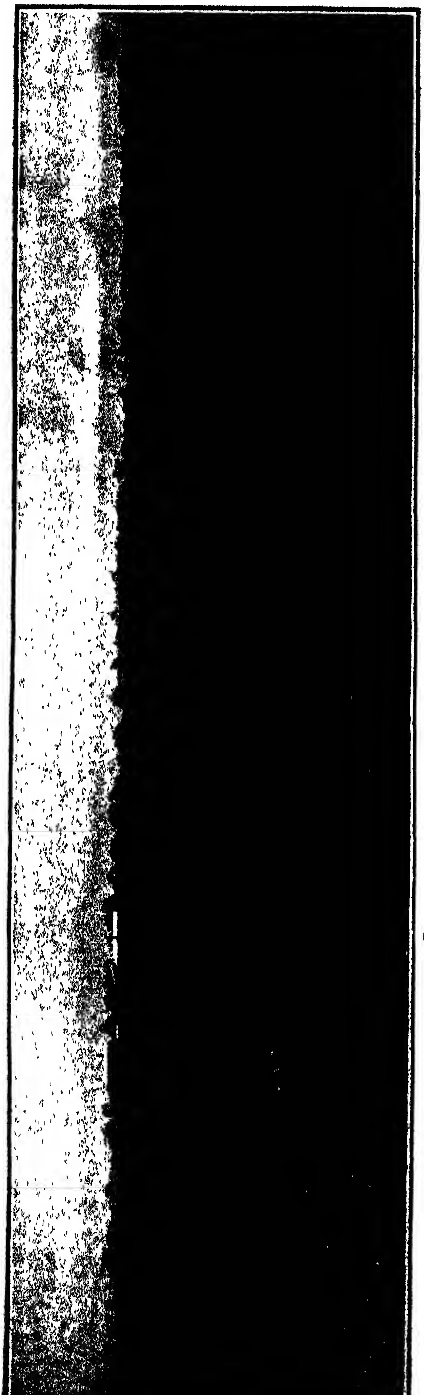


FIG. 5.—AN ALKALI PADDOCK REQUIRING DRAINAGE.

When is Draining Necessary?

Exactly at what height of the water table it becomes necessary to under-drain depends chiefly upon the physical character of the soil, as this affects capillarity. Dorsey* says that in porous soils with moderate alkali content anything less than 4 feet indicates the need of draining, while in lands heavily charged with alkali Loughridge† indicates ground water at 5 or 6 feet as coming within the danger zone. In these cases drainage is recommended as the only sure cure for alkali. Drainage, coupled with irrigation, furnishes a rapid means of leaching away the salts.

Drainage at Mildura.

At Mildura, under-drainage has been resorted to in the worst cases of alkali, and much valuable land now under vines and fruit has been reclaimed by this means. The methods pursued by Mr. Kelly are practically those followed in the district, and may be quoted. He sets the drains 4 feet deep and from 30 to 120 feet apart, according to the character and lie of the land, which is undulating. He uses 3-inch tiles for the leaders, and larger size for the mains, which deliver into a sump lined with wood, and measuring 5 feet by 2 feet. The sump method of draining is extensively practised at Mildura, and porous drift which carries off the drainage waters is usually struck at about 40 feet. Mr. Levien is at present draining a considerable area on the sump method, which answers the purpose well.

Drainage at Sparrovale.

Another example of the good effects of drainage in removing

* U.S.D.A. Bureau of Soils, Bul. No. 43.
† Univ. Cal. Exp. Sta. Bul. No. 83.

salt is seen at the farm of the Geelong Harbor Trust at Sparrovale, Geelong. Here several hundred acres of land which were too highly charged with salt five years ago to permit of successful cropping have been reclaimed by drainage and subsequent irrigation. The cure is not yet complete, but has sufficiently advanced to allow a magnificent stand of lucerne to establish itself on part of the area. The drains run 4 feet deep, are placed at a distance of 5 chains apart, and empty into large open channels, which are discharged by a windmill pump. The wide distance between the drains is permissible in this instance, because of the existence of a bed of shell in the subsoil, which allows of an extensive range of percolation.

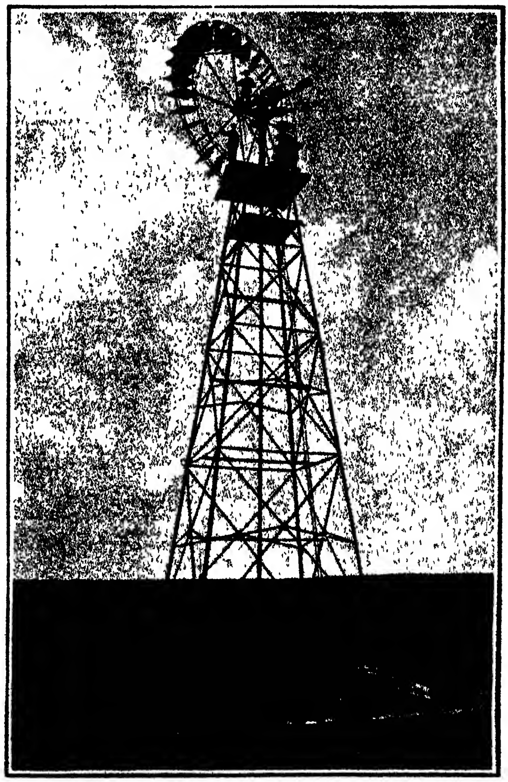


FIG. 6.—WINDMILL AND END OF OPEN MAIN DRAIN AT SPARROVALE.

American Experience.

Drainage, as already mentioned, is now extensively practised in America, in conjunction with irrigation, for the removal of alkali. Regarding the method of drainage, Dorsey* states :—"A drainage system to reclaim alkali land differs somewhat from the drainage systems commonly used in regions of abundant rainfall. To secure the best results, the drains are placed at a greater depth, and correspondingly wider apart. Drains should be at least 3 feet deep, and depths of 4 feet, and even 5 feet, will repay the extra cost." Widths recommended vary from 150 feet on heavy clay up to 300 feet on light sandy loams. "Tiles smaller than 4 inches have not given satisfaction on alkali lands owing to the difficulty in keeping them free from silt."

Open Drains.

Open ditches are as effective as closed drains, and have been extensively used in Egypt† and other alkali districts in Northern Africa. They need frequent cleaning, occupy valuable space, and require bridging. On this account they are inconvenient as small field drains, but are well suited for large mains that receive the surplus waters of small drainage systems.

* *Loc. cit.*

† Reclamation of Alkali Lands in Egypt. Bul. 21. Bureau of Soils.

Problem of Securing an Outlet.

In many cases the benefit of draining alkali lands is appreciated, but the practical difficulty is to obtain an outlet for the drainage waters. At Mildura, as was observed, an outlet is obtained on a farm by simply sinking a shaft to the porous underground drift. At Sparrovale the drainage is accomplished by pumping to a level at which the waters can flow away. At Murray Bridge, in South Australia, a similar pumping system is in vogue. Cases, however, may arise which are beyond the reach of individual effort. In America provision has been made to stimulate co-operation in several of the States by giving legislative authority to form drainage districts within which the necessary taxes may be levied. Such a system is now in operation in Illinois, and Hilgard,* an eminent authority on this subject, predicts that " Bitter experience will, doubtless, in time compel unanimity on this subject in California " (his own State). It is possible that in course of time the need for action based on either public or co-operative policy will force itself on public attention in Victoria.

Irrigation Water in Victoria.

It is sometimes said that irrigation brings alkali. So far as the irrigation waters in Victoria are concerned this is not the case, as these waters are particularly free from soluble salts. The latest considerable appearance of salt in Victoria is at Cohuna, but the irrigation water there is of a high class. The following analysis by the Chemist for Agriculture shows the composition of a sample of the channel water as supplied to the settlement:—

Composition of Irrigation Water.

	Parts per 100 00 '.
Carbonate of calcium	4.45
Sulphate of magnesium	1.12
Chloride of calcium	1.30
Chloride of magnesium	trace
Chloride of sodium	2.78
Total soluble salts	9.65

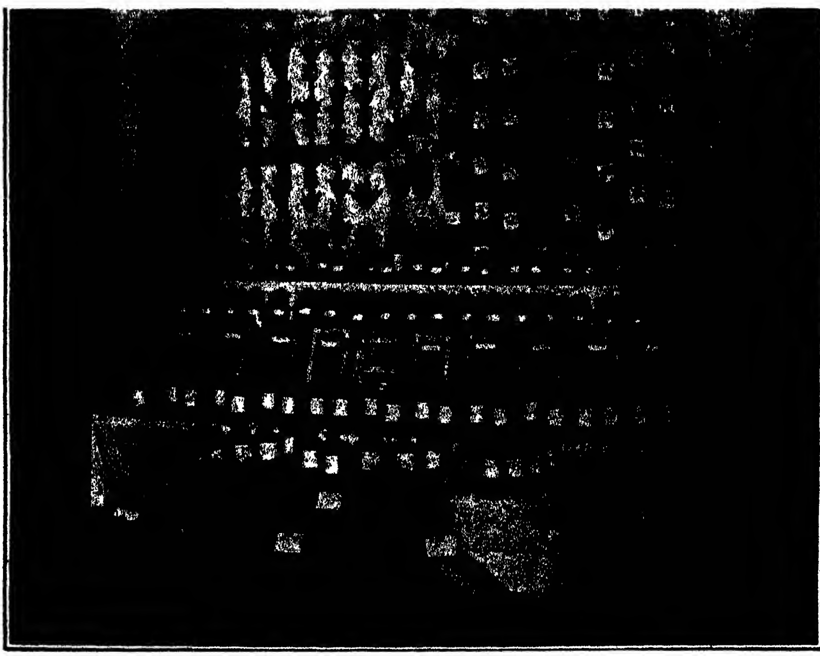
What happens is not that the water here adds salt in any important degree, but, as results in all irrigation, it tends to draw salt up in the soil and concentrate it in spots. Methods of counteracting this have been described.

Summary.

To sum the matter up, therefore, " alkali " means excess of soluble salts. These may limit, or even destroy fertility. The appearance of alkali is a world-wide phenomenon in arid or semi-arid districts. Irrigation does not form alkali, but concentrates it at the surface, where its action is most felt. The method of combating depends chiefly upon whether the water table is more or less than about 4 feet

* Soils by E. W. Hilgard, Ph.D., LL.D. MacMillan 1910.

deep. In the former case the evil may be surmounted by careful methods of cultivation. In other cases drainage appears an essential step. To obtain an outlet for such drainage, individual effort may suffice. In other cases co-operation is required. In several American States such co-operation is encouraged by legalizing the formation of drainage districts. The question of whether in particular cases further aid should be given raises matters of general policy with which this paper is not intended to deal.



VICTORIAN PRODUCTS FOR EXHIBITION IN AMERICA.

The Department of Agriculture has forwarded to Mr. F. T. A. Fricke, the Victorian Agent in San Francisco, a collection of Victorian products for exhibition there, and showing to would-be settlers from America the quality of products grown in the State. The collection, illustrated above, consists of 100 varieties of small sheaves of cereals, 50 bottles of wheat, oats, barley, peas, maize, &c., a couple of fleeces, sheaves of flax, and a bundle of flax fibre, samples of tobacco leaf, 4 doz. jars of assorted preserved fruits, and 10 boxes of dried fruits. The whole was prepared in such a manner as to make an attractive and educational display of the various products mentioned, and should be of much interest to those who think of making their homes in Victoria.

BEE-KEEPING IN VICTORIA.

(*Continued from page* 247.)

By F. R. Beuhne, Bee Expert.

XIV.—COMB-HONEY.

In Victoria, and in Australia generally, the amount of honey marketed in the comb is only a small fraction of the total production. In England, the United States, and Canada, a considerable portion, perhaps nearly one-half, of the honey used for table purposes is in the comb.

In North America, the production of comb-honey in 1 lb. sections has attained to large dimensions, and many large apiaries are run exclusively for the raising of high grade section-honey, high prices being obtainable for what is graded as "fancy." In the profitable production of comb-honey, considerable skill, and favorable conditions of climate and flora, are essential.

That a larger amount of honey in the comb is not consumed in Australia is often attributed to lack of enterprise of the apiarists, or to the absence of consumers willing to pay the extra price for honey in the comb, as compared with extracted.

Well filled sections of comb-honey with perfectly clean white cappings can only be obtained in localities which have a heavy honey flow lasting sufficiently long to insure uninterrupted work in the sections from start to finish. The profitable production of comb-honey is only possible under a combination of favorable conditions not present in every locality, and not every season. Comb-honey may, as a matter of fact, be produced whenever bees store more than is needed for their own immediate requirements, but very few bee-keepers are aware at what cost, through loss in yield, this is done when attempted under unfavorable conditions. There are seasons when bees will produce a fair amount of honey when given ready-built combs for extracted honey, but if compelled to work in sections, a very small yield of inferior comb-honey will result.

The true causes of the small production are, however, the climatic conditions of our country and the vagaries of blossoming and nectar secretion of our native flora. The yields of honey are equal to those obtained in any part of the world, when taken on an average for several years, but our high average is made up of a glut one season and a comparative dearth in the following. We have "on" and "off" years; and, while it is comparatively easy to produce good sections in the "on" year, it would be quite unprofitable to attempt it in the "off" year.

In the case of extracted honey, much of it is held over from one season to another without any deterioration in quality. Comb-honey, however, cannot be kept in perfect condition for any length of time, except with a considerable amount of trouble in providing dry warm storage. Thus, 1 lb. sections may be rather plentiful one season and almost unobtainable the following, and the prices proportionately high. Under these conditions, neither production nor consumption can be expected to increase.

Some ten to fifteen years ago, several apiarists produced comb-honey on a large scale, but abandoned its production for that of extracted honey. Much of the section honey which finds its way on to the market now is produced by bee-keepers in a small way; and in appearance leaves much room for improvement.

As already stated, skill is required to produce comb-honey profitably. The conditions necessary to make comb-honey production profitable are—1. A sufficient amount of the right kind of honey-producing flora within reach of the bees. 2. Atmospheric conditions favorable to the secretion of nectar and the flight of bees. 3. Strong colonies in which the maximum number of the workers are field bees. The factors 1 and 2 depend upon the locality, while the third is one depending upon the skill and energy of the bee-keeper; this should from the very commencement of the season be directed towards securing the greatest possible number of field bees in each hive at the beginning of the main honey flow, and to maintain the strength of the colonies while the honey flow lasts. Under Australian conditions, such as the irregular blooming of some of the honey-producing trees and the periodical scarcity of pollen, it is in some localities practically impossible to bring colonies to that condition which is necessary to the profitable production of first-class 1 lb. sections of comb-honey. In districts where the main honey flow begins shortly after the blooming of that valuable pollen plant, Cape Weed, there is little difficulty in having colonies in the right condition for comb-honey, provided that they had wintered well, and that each colony has a vigorous queen. Cape Weed is now so widely distributed over Victoria that there are few localities where it is not plentiful on any open spaces, for it does not thrive in close forest or scrub country, and is, therefore, absent in the vicinity of some of the best apiary sites in the State. In such localities the hives are often not in a condition to produce comb-honey at a profit, and the colonies had better be kept in a locality with a plentiful early pollen supply and shifted on to the honey site when the flow begins.

There are many other localities where Cape Weed and other pollen producers are plentiful, but too long an interval occurs before the honey flow commences, and the bees are then often in a backward condition, more so when, as is usually the case in such districts, there has been much swarming. Swarming is a factor that has to be reckoned with in the production of comb-honey. It is a well known fact that when extracted honey is produced there is much less swarming and no difficulty in keeping the colonies strong, particularly when the queen is given free access to the upper story or stories up to the time of the first extracting, or where the honey flow is very heavy throughout the season. When sections are placed on the hives, instead of extracting combs, the bees will be much slower going up into the super, and will become so crowded in the brood chamber that swarming results. Thus the worker-force is divided, neither the swarm nor the parent colony is in a condition to store surplus honey for two to four weeks, or longer, if the stock was only of medium strength before it swarmed.

Often before either of the two colonies is ready for storing in sections the best of the honey flow is over, and what usually occurs, particularly in the districts near Melbourne, is that the number of

colonies is doubled, a few highly coloured and stained sections are produced, a number of swarms abscond, and some of the later casts die of starvation before spring.

To deal successfully with the swarming problem in connexion with comb-honey it should, first of all, be understood that destroying the queen cells which are raised by a colony preparing to swarm does not prevent swarming, it only delays it, except when conditions unfavorable to the bees, such as bad weather or a stoppage of the honey flow follow immediately after the destruction of the queen cells.

Although the production of comb-honey in 1-lb. sections encourages the swarming impulse, yet there will usually be found in an apiary of any size a few colonies which, while equal to the best in population and yield of honey, go through one or two entire seasons without swarming. Such stocks give a maximum return for a minimum of labour and attention, and their number should be increased by rearing the young queens required from the queens of these non-swarmers.

To obtain the best results, the manipulation of the colonies should come under two different headings: 1. Preventive measures. 2. Control of the swarming impulse.

1. Preventive measures should commence long before there are indications of swarming. The brood chamber should never be allowed to become too crowded with bees, nor should it have any great quantity of honey in combs not occupied by brood; further, the less honey there is between the brood and the top bars of the frames, the sooner will the bees work in sections when the latter are put on. There are different ways of getting a colony into the right condition for work in sections, such as uncapping combs of sealed honey and inserting them, one at a time, between the brood at intervals of four or five days, or doing the same with extracted combs if honey is plentiful in the hive or coming in freely. Operations such as these, however, require an amount of time and labour which few Australian bee-keepers are prepared to give, neither is the artificial stimulation thus produced always an advantage. We cannot predict to a week or so when a particular honey flow will start, and it is therefore better to let the development of the colonies proceed on natural lines. The simplest way of getting a colony in the right condition will be found to be to allow an expansion of the brood nest upwards into a set of drawn combs, and then at the right time for putting the sections on, to put the combs containing the most brood, especially the sealed, into the lower body, shaking the bees off the surplus combs in with the others and using the combs to help on weaker stocks. When a two-story colony has thus been reduced to one set of brood combs and one or two section supers, the bees are forced to enter the sections at once. A few bait sections, that is, unfinished previous season's sections, put amongst the empty ones will be a great inducement for the bees to commence work at once. During hot weather the preventive measures should include enlarging the hive entrances and shading the hives during the hottest part of the day.

2. Controlling the swarming impulse. Even after everything possible has been done in the way of prevention, there will still be swarms, few or many, according to the strain or race of bees kept and the character of the locality. The swarming impulse may be controlled in two ways—by anticipating it, or by allowing natural swarming

to take place and reuniting some time after. The principle which underlies all methods for the control of the swarming impulse is an interruption in the hatching of young bees; this is what takes place in natural swarming. From the time a swarm commences work in the new hive at least 21 days elapse before young bees again emerge, by this time the swarm will have lost many of its former numbers, and is therefore not in a condition to give the best results. When swarming is anticipated, this interruption in the generations of hatching bees is brought about by the removal of the combs containing brood and the substitution of empty drawn combs or frames of foundation. This is usually done when a colony starts raising queen cells. If the colony, although preparing to swarm, is then not yet strong enough, the cell cups may be destroyed and the brood removed a week or a fortnight later. Under certain conditions of season, colonies deprived of all brood may be inclined to swarm out. This may be prevented by taking away half the brood combs, and when, five or six days later, young brood is found in the combs which were substituted for the brood, the remaining combs of adult brood may then be removed. The brood thus removed in anticipating swarming, may be given to backward colonies after shaking most of the bees off. Before any combs are taken from a hive, the whereabouts of the queen should be ascertained lest she may be injured in the shaking of the bees. Too many combs of brood should not be given to any very weak stocks, or much of it will be wasted on account of the inability of a small colony to take care of it.

This above method of swarm control involves a considerable amount of work and attention, and most bee-keepers find it more convenient to allow natural swarming to take place and, after a time, to reunite the swarm and the parent stock, thus getting the same force to work in one hive as if the colony had not swarmed at all. When the swarm issues it is hived on the same stand, while the parent stock is placed alongside, but with the entrance facing at right angles from the old position. Nearly all the flying bees which remained when the swarm came out will return to the accustomed place, and thus join the swarm, weakening the parent stock sufficiently to prevent after-swarms. If the bees are of a desirable strain, one of the queen cells in the swarmed stock may be allowed to hatch. This should be the most perfect and forward one, the others are destroyed. If the colony is not one of the best, cells raised from one of the best non-swarming stocks may be given. In from fourteen to twenty days, according to the maturity of the cell on day of swarming, the young queen should be laying. Twenty-one days after swarming all the worker brood will have hatched out, and the bees may be united with the swarm after removing the queen of the latter (the old queen) and the combs of the parent stock, if section honey is to be raised. (The method of uniting is described under Swarming, Chapter IX.) The colony is now in the best condition, with a young queen and new combs in the brood chamber. These are very desirable when clean, white sections are to be raised. From a colony manipulated in this way the writer, some years ago, obtained 312 beautifully finished 1-lb. sections in what is by no means a first-class locality.

Much of the faulty appearance of sections seen in shop windows, as well as most of the damage comb-honey suffers in transit on the

railways is due to false economy on the part of the producer, who provides the section boxes with only a small starter of foundation, as shown in the first section of the top row in the illustration. This section stands on one supplied with a full sheet of the thinnest foundation (12 to 13 square feet to the lb.) and a bottom starter.

The progress of the work of the bees may be seen in the second and third pair of boxes. The third one of the top row, although almost ready for sealing by the bees, is not fastened to the bottom of the section; while, in the lower tier, the comb is already fastened to the wood all round in No. 2 and completely fills the box in No. 3.

Apart from the quality of the produce, which would be the same in either case, there are two things to be considered in section honey, viz., appearance and weight. A section built from a starter will be partly sealed before comb-building is finished, and the cappings will often lose their virgin whiteness before the sections are ready for removal from the hive. Drone comb is also usually resorted to by the bees; and the finished section has not an even surface, nor is it fastened to the wood

1-LB. SECTIONS OF COMB-HONEY.
Upper tier from starters, lower tier, full sheets.

all round, and whatever spaces are left open increase the liability to break down in transit and to deduct from the weight.

When a section is built from a full sheet of the thinnest foundation and bottom starter the bees first of all join sheet and starter, as in No. 2 of the bottom tier. They then raise the comb simultaneously over the whole face and seal or cap it all over at one time, so that, when ready for removal, the capping is snow-white, the section full weight (15 to 16 oz.), and being a solid block of comb completely filling the box will not break down and leak in transit.

It is, however, important that only thin surplus foundation should be used, as stout foundation is objectionable when eating the comb. It should not be less than 12 square feet to the 1 lb. This grade costs 2s. 8d. per 1 lb., which will cut 100 full sheets and bottom starters, or 400 top starters as shown in first section of the top tier. The cost per dozen for foundation would thus be 4d. for full sheets and 1d. for top starters; but as well-filled snow-white sections, such as can only be obtained from full sheets, are worth from 1s. to 2s. per dozen more, there

is an actual gain of 1s. to 1s. 9d. per dozen in using full sheets and bottom starters.

There is yet another advantage in the use of full sheets; that is, brood and pollen are not so likely to find their way into the section boxes. When the brood-chamber consists, as it should do, of worker-comb, bees will often build drone comb and raise drones in the section boxes, when given the opportunity afforded by the use of small starters.

What has been said here should not be understood to mean that first-class sections cannot be obtained from small starters. Under the favorable conditions of a good honey flow and strength of colonies, first-class sections, fastened to the wood all round, may be produced without the use of full sheets and bottom starters in the sections, but what is saved in labour and cost of extra foundation is lost many times over in the smaller number of sections.

(*To be continued.*)

BITTER PIT IN APPLES—

This disease, which for many years has been the cause of heavy losses to orchardists, has become particularly menacing with the growth of the export trade. Its appearances are well known, but its origin is obscure. The matter seemed to call for joint action, and in 1911 the Federal Government, in conjunction with the States, resolved to conduct an inquiry. The matter was intrusted to Mr. D. McAlpine, who as Vegetable Pathologist in Victoria for many years had earned a notable reputation in the treatment of plant diseases, and in his first *Progress Report* he gives the results of his preliminary work. It is shown that neither insects nor fungi, bacteria nor external agencies, such as spraying, are concerned in the production of bitter pit. The cause rather is internal, and must be sought for in a study of the structure and physiological processes of the apple itself. A record of the work done in this sphere forms a large part of the report. The principal contributing factors to the disease are—(1) changeable weather conditions at a critical period of growth, (2) amount and rapidity of transpiration by the apple, (3) sudden checking of transpiration at night, (4) failure of water supplies under the skin of the fruit, followed by irregular recovery, (5) inequality of growth, (6) fluctuations of temperature during storage, (7) nature of the variety. These factors are more or less susceptible of control by approved methods of cultivation, selection, and storage, and further work of a practical character is outlined for next season in determining the effect of soil, cultivation methods, manuring, irrigation, selection of stocks, and systems of pruning. The results of the next report will be awaited with interest. Incidentally it is noted that when apples are kept at a temperature of 30-32 degrees Fahr. the development of bitter pit is retarded.

FARM SANITATION.

By C. H. Wright, Instructor in Plumbing, Swinburne Technical College, Hawthorn.

(*Continued from page* 220.)

PART 2.—SEPTIC TANKS AND SEWERAGE CONNEXIONS.

Place all your sanitary fixtures on or near an external wall and nearest to the drains. If on different floors, have them placed as much as possible above one another.

DRAINS.

Only good salt-glazed pipes should be used for septic tank work.

Except in the case of very large establishments, the diameter of a drain need not be more than 4 inches. Drains needlessly large are not properly cleansed by the flush.

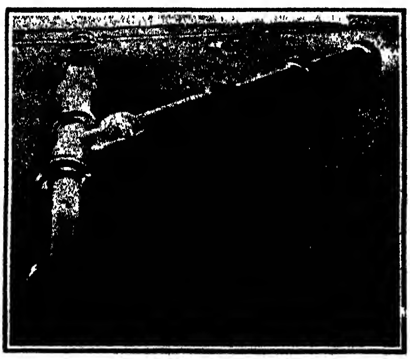


Fig. 12. Showing how a short branch drain should enter a main drain.

Fig. 13. Showing how a long branch drain running at right angles to the main drain should enter the main drain with an oblique junction and a bend.

Junctions are always used in connecting branches to main drains. It is important to remember that tributary drains join main drains obliquely, as shown in Figs. 12, 13, so that the sewage enters in the direction of the flow, otherwise splashing will occur, and this is likely to lead to a gradual deposit of dry sewage above the water line.

Bends in drains should be avoided as far as possible. When unavoidable, the curve should be an easy one. Bends are made 12, 18, and 24 inches long, and in angles of 15, 30, 45, 60, and 90 degrees.

Fig. 14 shows 4-inch bends of different degrees.

Fig. 15 shows an inspection opening, commonly termed an I.O., in position. It is used as a means of cleansing a drain in case of a stoppage. The opening is closed by a disc that can readily be removed.

Fig. 16 shows a gully trap and basin. It should be fixed within easy reach of the back door. No drainage system is complete without one, for its use is to receive liquids too objectionable to pour down the waste pipe of an inside fixture.

Fig. 17 shows a disconnected trap and adjustable tops and level inlets, used to receive waste pipes.

In every case the waste pipe must enter at other than the opening directly over the trap; this is so that an obstruction can be cleared without displacing any fitting.

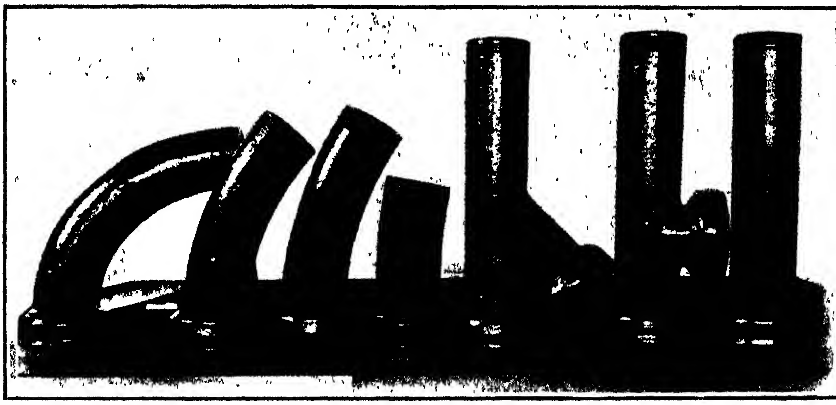
These drain traps are designed for the interception of gases only, and are of a self-cleansing form.

Joints.—There are a great many patent joints used for jointing stoneware pipes, but the popular joint of Melbourne and suburbs is a joint made with gasket and cement.

Fig. 18 shows a section of such a joint.

Hemp spun yarn is first rammed into the joint, and it is then filled with a stiff composition of cement and sand. Great care must be taken to prevent any of the hemp from entering the bore of the pipe, as it becomes saturated with cement, hardens and readily catches paper, &c.

Joints should be made with great care, and must receive keen attention all around to avoid the possibility of a leak.



A B C D E

Fig. 14. Stoneware pipes and fittings—
A.—24 inches x 90 degrees bend.
B.—45, 30, 15 degrees bends.
C.—Oblique junction.
D.—Inspection opening.
E.—Straight pipe.

Trees growing in close proximity to the line of drains should be cut down. If there is the slightest risk of tree roots invading the pipe trench, the pipes likely to be affected should be surrounded with 6 inches of concrete, composed of 1 portland cement, 2 clean sand, 5 stone of 1½-inch gauge.

The laying of sewer pipes under buildings cannot be too strongly condemned, but if absolutely necessary, cast-iron pipes with leaded joints should replace stoneware. In any case where stoneware piping is under a building it must be surrounded with 6 inches of concrete.

Concrete should be placed around and under gully basins, around the top of stoneware drains where they connect with vent pipes—this will prevent damage by rough usage.

It should also be placed under and around bends rising vertically and under the bases of all drainage traps. This helps to prevent the fracture of drains by settlement.

Fall.—Drains should have a fall of from 1 in 30 to 1 in 60. Those with two little fall have a sluggish flow of water, and are liable to silt up. Those with too much are liable to cause solids to be left stranded by the rush of water.

Stoneware drains should be laid with a depth of at least 2 feet from the surface to the centre line of the pipe. If the ground is soft and liable to heavy traffic, cast-iron pipes should be used.

All drains should be laid perfectly straight from point to point.

Any changes of direction should be made with curved pipes or oblique junctions. These junctions will provide openings that a rod may be passed through in case of a stoppage. (Fig. 19.)

On occasion of a drain pipe being carried through a wall, a space of about 3 inches should be left over the pipe to allow for any settlement in the building.

Fig. 15.—Showing a trench in good ground and an inspection opening in position.

Venting of Drains.—Although the foul gases arising in the septic tank should be prevented from entering the drain, so any gas generated in the drain pipes is prevented by the different traps from entering the air at inconvenient levels. Provision must be made for the escape of foul air at high levels by the aid of vent pipes. These vent pipes will enable a complete circulation of fresh air to pass through the whole system. There must be two openings—one an induct vent, and one an educt vent. Any branch drain over 15 feet must also be provided with a vent opening.

These vent openings are indicated on plan. (Fig. 20.)

The heights of drain vent pipes will be referred to later.

EXCAVATING TRENCHES.

The trench need not be wider than is necessary to allow the pipelayer to work at the bottom. The length to be opened at one time

must depend on circumstances. For testing purposes, it is better to extend the trench so that the whole job may be laid complete. This may have to be modified if the ground is of an unstable nature from recent rains or other causes. If the trench passes close to buildings or walls so as to endanger the foundations it is advisable to keep it open as short a time as possible; the trench would then have to be dug in short lengths.

When the trench exceeds a certain depth, and the nature of the soil will allow, or rock is met with, it may be found cheaper to drive a heading—but in this case very close supervision is necessary.

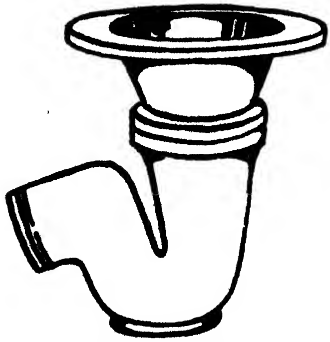


Fig. 16. A gully trap and basin.

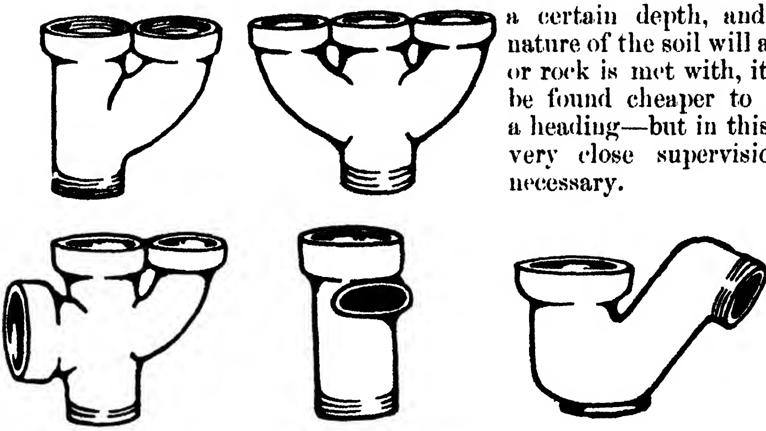


Fig. 17.—Disconnecting trap and adjustable tops to receive waste pipes.

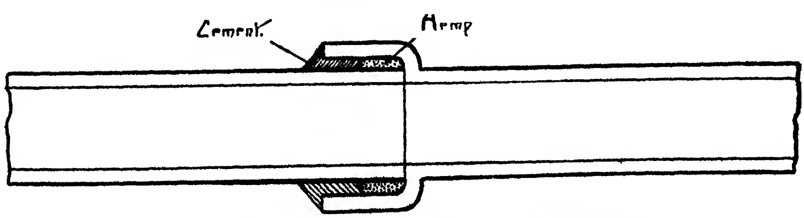


Fig. 18.—A section of a joint in stoneware pipes.

There are various methods of timbering a trench. For instance, in firm ground during rainy weather it may be necessary to timber as in Fig. 21.

In moderately firm ground, as in Fig. 22, and in sloppy wet soil, as in Fig. 23.

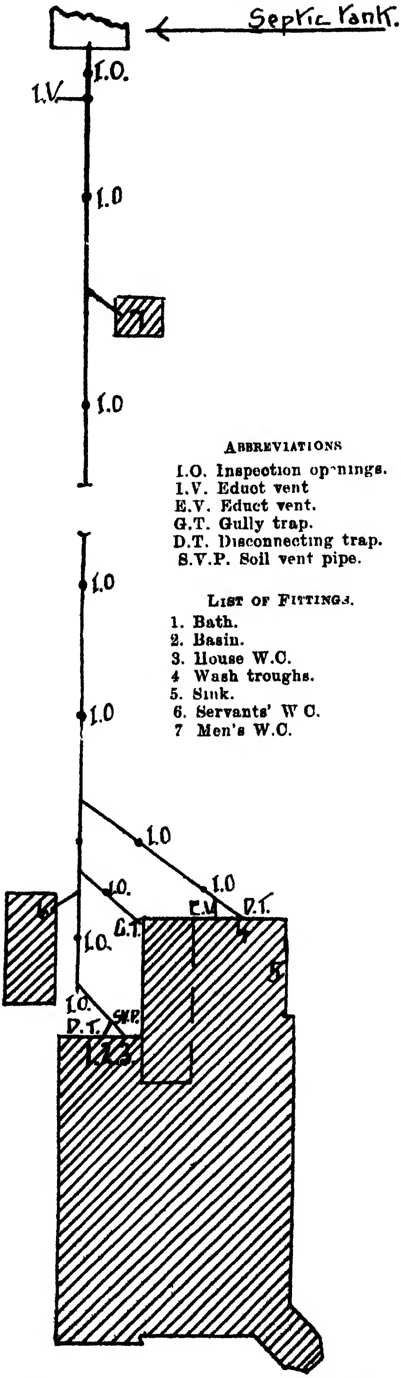


Fig. 20. A simple plan of a drain-pipe system.

Planning.—When the position of the septic tank, the water closets, and disconnecting traps have been decided upon, a simple plan, to scale, should be drawn. Such a plan will facilitate designing, guide the contractor and workmen, and enable a permanent record to be kept for future reference in case of alteration or repairs.

Drainage plans for city use are generally drawn on a 40-ft. to 1-in. scale, but 20-ft. to 1-in. will be found more convenient.

Start by planning first the main building, second the outbuildings, and then the septic tank. Make sure to have all buildings in their correct position and true to measurements. Then the positions of the disconnecting and gully traps, water closets, &c., should be shown, and, finally, the vent pipes and inspection openings. Such a plan is shown in Fig. 20.

Testing of Drains.—After drains are laid and jointed up they should be tested for leaks; this is done as follows:—All inspection openings are closed with testing discs, or else extended temporarily to surface level. The outlet end, rod eyes, and other horizontal openings must be closed by a testing disc, then the whole drainage system, if not too large, is filled with water to the surface level, the joints are then examined for leaks. Leaky joints are marked and made good when the water is run off. The inspection openings are sealed down and the earth filled in. Ramming must be avoided or displacement will follow.

The contracting sanitary engineer who understands his business will plan correctly, use the right kind of stoneware pipes and fittings,

Fig. 19.—Showing how a change of direction may be made by aid of an oblique junction and a bend, making provision for cleaning purposes.

and set about his work in a straightforward manner. He will deal with good and bad ground and surmount difficulties that continually

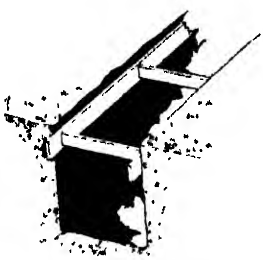


Fig. 21. Simple timbering where surface only is soft and likely to fall in trench.

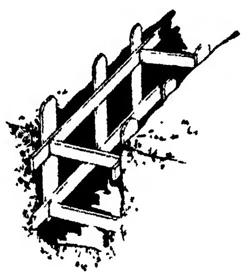


Fig. 22. Showing timbering in moderately firm ground.

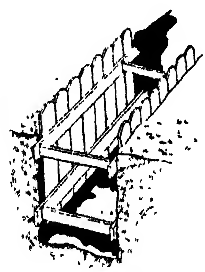
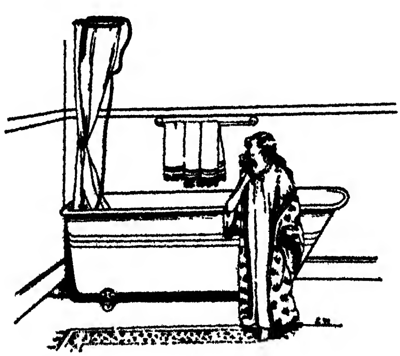


Fig. 23. Method of timbering in wet soil.

arise in drainage work in a manner that puts to shame the worried efforts of the inexperienced.

(*To be continued.*)



THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STANDPOINT.

(*Continued from page* 211.)

PART VII.—PRE-COOLING AND TRANSPORTATION PROBLEMS—*continued.*

By E. Meeking, Senior Fruit Inspector.

Although further quotation of the results attained in America in connexion with experiments regarding the utility or otherwise of

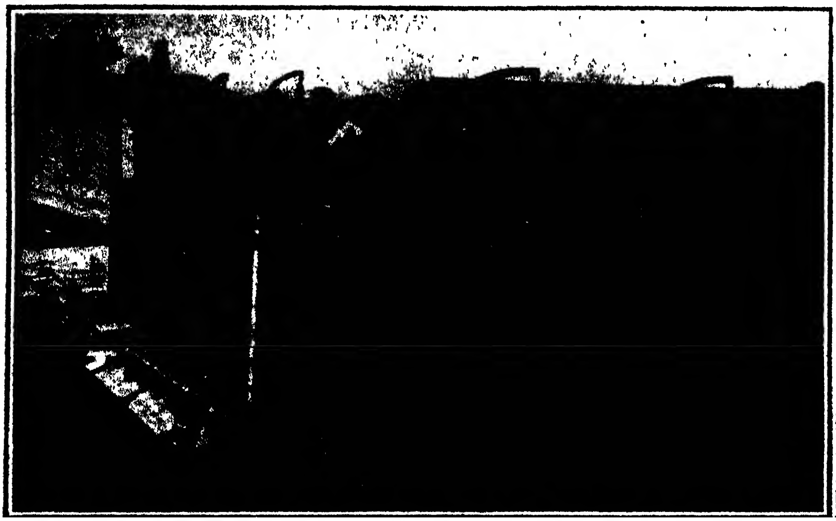


Fig. 1.—General view of pre-cooling car (at the left) containing the machinery and coils for cooling the air which is circulated through the air pipes suspended above to the car of fruit beyond.

Fig. 2.—View showing the cold air pipes connected to a refrigerator car loaded with fruit.

pre-cooling fruit may be considered as undue repetition, yet as a large number of those interested in the fruit industry in this State are of the opinion that pre-cooling is unnecessary and involves needless expenditure, the subject cannot be dismissed without some added reference to the matter, firstly, to show how essential the prompt application of low temperatures to fruit as soon as possible after harvesting is considered in America; and, secondly, to furnish a basis for suggesting later the system of pre-cooling it may be desirable to adopt in this State. The following extracts are taken from a report in the *Year-Book for* 1910 *of the Department of Agriculture,* U.S.A., furnished by Messrs. A. V. Stubenrauch, Expert in Charge of Fruit Transportation, and S. J. Dennis, Expert in Refrigeration, Bureau of Plant Industry:—

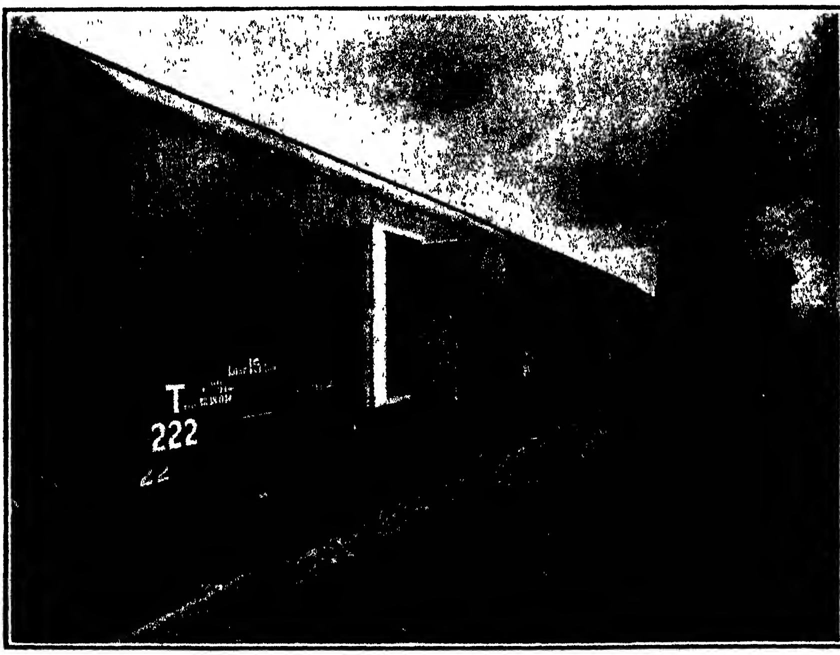


Fig. 3.—Type of insulated car used in Victoria for carriage of fruit.

"The ideal system of pre-cooling for all conditions has not yet been found. While the process has not yet wholly passed the experimental stage, its importance as a means of promoting the safe transportation of fruits for great distances has long been fully recognised, and its use will be extended as rapidly as the principles can be worked out and their practical application under different conditions and to different crops demonstrated. . . .

"A fruit may be considered as a living organism which has a definite span of existence, the length of this span depending upon the conditions surrounding the organism. The most important factor which modifies this span of life is temperature. When the fruit is removed from the parent plant the life processes constituting ripening are materially hastened, and the life span is greatly shortened if the fruit is allowed to remain warm for any considerable length of time.

Hence the importance of reducing the temperature as promptly and rapidly as possible after the fruit is picked. . . .

"The prompt and rapid reduction of the temperature below the point where the decay spores will germinate prevents the development of the disease, and even fruit which has been rendered extremely susceptible through mechanical injury of some kind can be transported with only slight loss from decay when promptly cooled."

Summed up, so far as the experiments have proceeded, these have shown that pre-cooling, although not by itself providing a means for safely transporting fruits over long distances, is still essential for carrying this into effect. This is particularly the case with respect to soft fruits, such as peaches, pears, and plums, and to a lesser degree with regard to apples and other hard fruits. If this is so in America, surely the argument applies with equal force to Victoria, where our average summer temperature is quite as high as that of America.

Local Temperature Experiments.

During the current export season a series of temperature tests have been taken with respect to non-pre-cooled and pre-cooled fruit transported to the seaboard in various types of railway trucks and under differing conditions. In the absence of thermograph installation in the trucks, the temperature at time of loading or the fluctuations of temperature during transit could not be recorded.

Non-pre-cooled.

Type of Truck.	Outside Temperature.	Temperature Inside Truck.
Louvre	80 degs. F.	65 to 70 degs. F.
"I"	80 ,,	75 to 78 ,,
"T"	80 ,,	66 degs.
Louvre	90 ,,	75 to 80 degs.
"I"	90 ,,	84 to 90 degs
"T"	90 ,,	70 degs.

Pre-cooled at Government Cool Stores, Melbourne.

Outside Temperature.	Temperature Inside Truck.	Temperature of Outside Tiers of Fruit.	Temperature in Centre of Load.
—	67.33 degs.	59.33 degs.	61.33 degs.

Pre-cooled at Country Cool Stores.

Outside Temperature.	Temperature Inside Truck.	Temperature of Outside Tiers of Fruit.	Temperature in Centre of Load.
—	67.33 degs. F.	59.33 degs. F.	61.33 degs. F.

In connexion with non-pre-cooled fruit, the records have been taken with respect to (*a*) fruit forwarded in louvre trucks, (*b*) fruit forwarded in "I" trucks, and (*c*) fruit forwarded in insulated "T" trucks. These records show that when pre-cooling is not carried out, the fruit, irrespective of the type of truck or car which may be used, arrives at the ship's side during periods when the outside temperatures are such as to ripen the fruit if exposed to same for a short period after severance from the tree.

Shipments of fruit forwarded without pre-cooling from stations in the country are thus, during the hotter portion of the export season, apparently taken on board exporting vessels at average temperatures of 70 to 90 degrees Fahr. As experiments in this State and in the United States of America have shown that a single case of wrapped apples, if stored at a temperature of 80 to 85 degrees, requires to be stored from 48 to 60 hours before the temperature of the centre rows of fruit in the case can be brought down, under ordinary cool storage conditions, to the necessary 30 to 32 degrees F., it may be imagined the length of time which would be required to cool a shipment of, say, 20,000 to 30,000 cases to the centre of the shipment. When, in addition to this, the facts that hot fruit is sometimes loaded at other ports *en route*, and that the shipping companies often carry the fruit at temperatures much too high, are taken into consideration, some of the reasons for such large percentages of shipments arriving each season on the London and Continental markets in an inferior condition are not far to seek. The matter will be further mentioned later when remedies are suggested for improving our methods of harvesting, handling, and transportation.

Concerning the records taken in connexion with fruit which has been pre-cooled, these were taken with respect to consignments pre-cooled at the Government Cool Stores, Melbourne, and country cool stores, and forwarded to the s.s. *Argyllshire* at Williamstown in ordinary insulated trucks of the "T" type without icing. The records show that, although the fruit forwarded under these conditions arrived at the ship's side at temperatures much nearer the correct ones than the fruit forwarded without pre-cooling, yet the temperatures in connexion with these were much higher than desirable.

As the temperature of the fruit at time of loading averaged from 31 to 32 degrees F., it will be seen that even in the short space of time occupied in the journey from the Government Cool Stores to Williamstown a rapid rise of temperature had taken place. This goes to show that pre-cooled fruit should be conveyed in trucks whose temperature at time of loading is approximately the same as the temperature of the cool chamber from which the fruit has been removed, and that regular icing is necessary to keep the temperature of the car from fluctuating. It appears to support the results of the experiments in America, which have shown that the ideal system of transporting fruit is rapid and prompt pre-cooling, together with transportation in cars under regular icing. Neglect of attention to these matters is probably the reason why much of our fruit when marketed at the other end of the world often presents, according to reports, a shrivelled and wilted appearance.

The results obtained in this State and elsewhere have shown that soft fruits may be kept in cool storage over lengthened periods and

transported over long distances, provided careful and systematic methods of harvesting and prompt application of cool temperatures to the fruit is carried out. The evidence has shown, moreover, that if these methods are neglected, unsatisfactory results will follow. This has been frequently pointed out in the columns of the *Journal* since October, 1907, and also in Bulletins issued by the Department. The following facts in connexion with shipments is submitted as evidence in support of the contention:—

Date.	Vessel.	Kinds of Fruit.	Conditions under which fruit was shipped.	Results as per Agent-General's reports.
14.2.11	*Somerset*	Apples, Pears, Peaches, Plums, Grapes	Pears, Peaches, Plums and Grapes *pre-cooled* at Government Cool Stores. Apples *pre-cooled* in ship's hold prior to loading of soft fruits. Forwarded to ship in insulated cars	Shipment landed in good order, pears averaging 13s. per case
3.2.12	*Themistocles*	Apples, Pears, Peaches, Plums	*Not pre-cooled.* Forwarded in ordinary louvre trucks to ship	Arrived in poor condition and very spotty; in some cases shrivelled and wilted
4.2.12	*Ascanius*	Apples, Pears, Peaches, Plums		
19.2.13	*Somerset*	Apples, Pears, Peaches, Plums	Pears, Peaches, and Plums *pre-cooled* at various cool stores and carried in separate chamber	(As per cabled reports) Pears and plums in excellent condition. Peaches worthless

(*To be continued.*)

MAMMITIS OR GARGET IN DAIRY COWS.

By R. J. de C. Talbot, B.V.Sc.

Mammitis, or inflammation of the udder, is a disease which is very common amongst dairy cows in the State.

It may occur in many forms, and be due to a variety of causes.

If dairy farmers would seriously consider the monetary loss sustained by them every year through temporary or permanent loss of milk due to this disease from one or more of their cows they would discover the amount to be a considerable sum.

It therefore behoves those engaged in the milk producing industry of this State to become alive to the seriousness of this disease and the danger of it becoming a greater scourge than it is at present.

The checking of contagious mammitis and ultimate eradication of it from a herd can only be brought about by care in selection at buying, proper sanitation of milking premises, cleanliness of milking (whether by machines or hand), and isolation and proper treatment of all cows showing symptoms of this disease.

The disease is in most cases capable of being transmitted from one cow to another; that is to say, it is contagious, the degree varying to a considerable extent.

In some forms of contagious mammitis, one cow in a herd may become affected with what might appear to be a simple case of the non-contagious form of the disease, and unless proper precautions are taken, in a very little while a number of the other cows being milked become affected in one or more quarters.

In this case the germs causing the disease have been carried from cow to cow on the hands of the milkers, or, if machines are in use, by the cups.

It will thus be seen that this contagious form of mammitis may become a very serious menace to a dairy farmer, as the milk yield of all cows affected falls away to practically nothing, and very often an attack of the disease is followed by occlusion, or stoppage of the teat duct, and subsequently by the loss of that particular quarter, hence the necessity of early recognition of the disease, isolation of affected animals, and proper methods of treatment.

CAUSES.

The very structure of the udder favours inflammatory processes; it has a good blood supply, the interior is almost in direct communication with outside influences, and the milk forms an excellent medium for the growth of most bacteria.

Acute inflammation of the udder is most common during the period of lactation; it is very unlikely to occur in a dry cow.

The most common cause of mammitis is the introduction into the udder, by way of the teat duct, of bacteria capable of causing inflammation, and opportunities for infection by this means are frequent.

The severity of the attack depends upon the virulence (or strength) of the germs which gain entrance.

The entrance of these bacteria into the udder is facilitated by milking cows in sheds which are kept in an insanitary condition, or by allowing the animals to stand about in dirty yards prior to milking.

Cows milked by machines which are not frequently sterilized, or by persons with unclean hands, are more liable to infection than those milked under proper hygienic conditions.

The introduction into the teat of improperly sterilized teat syphons, pieces of wire, straws, &c., is a frequent source of infection.

Mammitis may result from a cow not being milked for some time (as occurs in drying off). In this case the disease is caused by the decomposition and growth of bacteria which occurs in the retained milk.

The contagious form of the disease may be carried from cow to cow by means of the cloth which is used to wipe the udder prior to milking, and it is also possible for infection to be carried by flies.

Simple mammitis is sometimes brought about by the vacuum pressure of machines being too severe. This pressure may cause rupture of some of the small blood vessels of the udder.

Acute inflammation may result from some external injury to the udder, such as a stake (due to animal lying on a sharp stick), dog bite, or wound caused by the horn of another cow.

Another form of the disease is that associated with tuberculosis of the udder.

Actinomycotic mammitis which is due to the entrance into the udder of the ray fungus (the cause of lumpy jaw in cattle) appears to be more common in Victoria than in other parts of the world.

Both these latter forms are chronic and incurable, and their diagnosis is so difficult to non-experienced persons that they will not be further mentioned in this article.

SYMPTOMS.

The disease sets in suddenly, and may attack one or more quarters. Usually the first intimation that anything is wrong is that the milk drawn from a particular quarter contains a few clots; it may also be watery; in a short time the clots become more numerous, and the milk shows a tendency to rapidly coagulate. These changes are always more pronounced in the first milk drawn off.

In mild cases of the disease the alteration in the character of the milk may be the only change which is noticed, and sometimes the disease clears up after a few days, the milk gradually becoming normal again.

In more severe cases the changes in the milk are accompanied by swelling and redness of the affected quarter; it is painful to the touch and abnormally warm; if one of the back quarters is affected, the swelling and pain will interfere with movement and cause lameness; frequently there is an enlargement of the lymph glands situated above and behind the udder.

As the disease advances, the changes in the milk become more pronounced; there is a great diminution in the yield, the quantity gradually becoming less and less. What milk there is, is thick, yellowish, and viscous, due to the fact that it contains a large quantity of pus and sometimes blood. The udder now becomes hard, tense, and swollen. The teat duct appears as though it were choked with some hard substance, and frequently small hard nodules about the size of a pea may be felt at the base of the teat.

In severe and advanced cases, abscesses may form on the lower portions of the udder, and subsequently gangrene may occur. In these latter cases the general health of the animal suffers; it becomes feverish, with a high temperature, the appetite is lost, thirst is excessive, and the animal is depressed. Death sometimes follows these very acute cases.

It should be borne in mind that in some forms of contagious mammitis, practically the only changes to be noted are a slight alteration in the character of the milk, associated with thickening of the lining of the teat duct. These are the cases that are dangerous, because, on account of the apparent lack of symptoms, the disease, if recognised at all, is not treated as serious. The cow is milked as usual, and in a short time, especially if machines are being used, many of the other cows become affected.

TREATMENT.

It is always wise to treat all cases of mammitis as though it were contagious, as in many cases it is.

A soon as a cow is suspected of being affected, she should be isolated.

If milking machines are in use, they should on no account be used on her. She should always be the last cow milked, and, after milking her, the hands of the milker should be well washed in some antiseptic solution (lysol, phenyle).

The milk from affected cows should on no account be milked on to the floor of the milking shed; it should be drawn off into some old dish kept for the purpose, and then thrown on to a fire.

In all cases of mammitis it is very important to withdraw the milk frequently, every hour if possible, and after each milking the udder should be lightly, but thoroughly, massaged to assist the discharge of the secretions from the finer milk ducts. The application of small quantities of camphorated oil during massage assits the operation, and is very beneficial.

In acute cases, fomentations of warm boracic water should be applied frequently, but care should be taken that the water used is not too hot, and the foment should not be allowed to remain on until it is cold. All cloths before being used should be well boiled with washing soda.

In some forms of the disease injections into the udder of boracic acid solution are of great value. The solution is prepared by dissolving a dessertspoonful of pure boracic acid in a pint of boiling rain water, and allowing to cool.

The cow should be thoroughly milked, and the surface of the udder and teats well washed with an antiseptic solution (2 per cent. lysol). About a quarter of a pint of the boracic solution should be injected, into the affected quarters by means of an ordinary enema syringe, the nozzle of which has been replaced by a teat syphon; it is most important that both syphon and syringe should be well boiled both before and after being used on any particular quarter. After injection, the fluid should be allowed to remain in the udder for about a quarter of an hour, during which time the affected quarters should be well massaged. This treatment should be applied twice a day, in conjunction with that already recommended.

In some forms of mammitis, where the teat duct is blocked, a teat syphon may be used to draw off the milk, but the syphon should be boiled in a strong soda solution for at least ten minutes both before and after use, and should never be pushed roughly up the teat. If these precautions are not taken, the syphon will do a great deal more harm than good.

Hairpins, pieces of wire, &c., should not be pushed up the teat for the purpose of making the milk flow.

Owing to the difficulty in differentiating the early stages of contagious mammitis from the non-contagious forms, all cases of the disease should be looked upon with grave suspicion, and, as already stated, isolation and the above-mentioned treatment should be rigidly carried out.

PREVENTIVE TREATMENT.

The occurrence of all forms of this disease (as has already been stated) may be greatly reduced, if not actually prevented, by the adoption of sanitary and hygienic methods of milking.

The milking shed should be situated on high land, so that it can be easily drained. The floor should be so constructed that it is impervious to moisture.

The inside of the shed and all fittings must be kept scrupulously clean, and should be frequently lime-washed. The yard where the cows have to stand prior to being milked should be paved; if this is not possible, it should at least be kept free of all manure, &c.

Before the cows are milked the udders should be well washed, special attention being paid to the teats (after washing, dry well).

The practice of wetting the hands in the pail of milk cannot be too strongly condemned; if the hands are required to be moistened, a small dish of clean water should be kept for this purpose.

Milking machines, if not kept clean, may become a potent factor in the dissemination of infection among the cows. The cups and milk tubes should be boiled before each milking and after being taken off each cow; steam from a jet should be forced through them. When not in use, they should be kept immersed in mild inodorous antiseptic solution such as boracic acid. If a steam jet is not available, the cups, after use on each cow, should be plunged into a strong boracic solution and then rinsed in pure water immediately afterwards.

(It is thought by some that boiling the cups, tubes, &c., is liable to perish the rubber, this, however, is not the case if the boiling is carried out carefully.)

Before applying the cups, the milk from each quarter should be examined in order to detect the first noticeable indication of the disease.

On no account should machines be used on affected cows.

Cows that are newly introduced into a herd should be examined, and machines should not be used on them until it is certain that they are free from any disease of the udder.

All suspicious cases should be at once isolated, and treatment should be conducted along the lines already recommended.

RELATION OF FERTILIZERS TO FERTILITY—

In his presidential address to the agricultural section of the Science Congress, Mr. F. B. Guthrie, of Sydney, gave an able *résumé* of present views on this subject. Fertilizers were undoubtedly of benefit in supplying essential constituents of plant food, but their action did not end there. They had an influence, more or less, upon the physical condition of the soil, upon the micro-organisms in the soil, and in altering its chemical balance. Special attention was devoted to the presence of soil poisons, or toxins, which apparently might affect fertility in at least an equal degree with a deficiency of plant food. These toxins might be secreted either by the growing plant or by changes, bacterial or otherwise, in the organic matter of the soil. Diseases in man and animals were combated by the discovery of substances which retard their progress, and it might be hoped that substances might be discovered which would render harmless the toxins produced in soils. Different toxins had their anti-toxins, and experiments were quoted showing how phosphoric acid helped to destroy some toxins, nitrate of soda others, and sulphate of potash those of still another class. They might also prevent their formation. Investigation as to the formation, character, and effect of the various soil toxins was pressing upon agricultural scientists, and the belief was expressed that many fertilizers which we now apply to furnish plant food " act less by virtue of any special plant food with which they supply the crop than through their power of retarding or preventing the formation of substances hostile

to plant growth." These considerations affected simply the manner in which manures possibly act; they must "not be taken to suggest that we should cease to manure with the recognised fertilizers."

REPORT ON SECOND EGG-LAYING COMPETITION.

The Second Egg-laying Competition came to a close on the evening of the 14th instant, and the Third was entered upon, when the change of birds was satisfactorily carried out. Appended are the results of the Competition. The prizes offered for competition were won by the following:—

Greatest number of eggs laid by any pen during currency of Competition:—

First prize (£7 7s.).—S. Brown, Gembrook South (white leghorns), 1,468.
Second prize (£5 5s.).—J. E. Bradley, Newport (white leghorns), 1,454.
Third prize (£3 3s.).—E. Waldon, Morwell (white leghorns), 1,413.

Greatest total number of eggs laid by a pen during the first four months of the Competition, terminating on the evening of 14th August (winter test):—

First prize (£4 4s.).—S. Brown (white leghorns), 480.
Second prize (£2 2s.).—G. Edwards, Mentone (white leghorns), 456.

Greatest number of eggs laid by a pen of a class other than that gaining first prize:—

Special prize (£3 3s.).—H. A. Langdon (black orpingtons), 1,245.

Pen from which the eggs realized the highest market value throughout the Competition:—

Special prize (£3 3s.).—S Brown (£7 14s 4d. value).

The special prize given for the pen the eggs from which show the greatest average weight per dozen was won by Mr. C. J. Beatty with a pen of white leghorns, which laid 1,353 eggs valued at £7 3s. 7½d., the average weight per dozen eggs laid being 26.92 ounces.

Mr. Chalmers' pen of minorcas laid an egg averaging 29.23 ounces per dozen, but as the number laid, 929, is not 75 per cent. of the number laid by the winning pen, he does not win the prize. The same applies to Mr. F. R. De Garis, who, with leghorns, shows an average weight per dozen of 27.8, but with only a total of 1,078 eggs.

The score shows that, though the winning pen was some distance behind the winning pen of the First Competition, the general average is a considerable advance, there being an increase of ten eggs for each pen over that of last year.

The average market price for eggs was 1s. 3½d. per dozen; the actual market value of the 80,865 eggs laid being £406 12s. 6d.

SUMMARY.

Number of pens ...	69
Number of birds	414
Total number of eggs laid	80,865
Average market value per dozen ...	1s. 3½d.
Market value	£406 12s. 6d.
Greatest number of eggs per pen	1,468
Average number per hen, first pen	248
Average number per pen	1171.9
Average number per hen	195.35

Results of the Second Egg-Laying Competition, Burnley, 1912-13.

Pen	Owner.	Breed.	Total Eggs to Date.	Position in Competition.	Market Value.	Average Weight per Dozen.	Weight of Eggs to Date.
					£ s. d	Lbs.	Lb.
1	John Campbell ..	White Leghorn ..	1,313	12	6 15 7¼	25 02	2,738
2	B. Rowlinson ..	" " ..	1,206	31	6 4 5¼	24·104	2,427½
3	King and Watson	Black Orpington	1,195	36	6 8 9¼	24·28	2,418¼
4	W. L. Blackburn	White Leghorn ..	1,032	56	5 0 10½	24·47	2,105
5	I. H. Brain ..	" " ..	1,301	14	6 10 1¾	22·9	2,484¾
6	J. B. McArthur .	" " ..	1,137	44	5 16 1¾	25·22	2,380¾
7	A. H. Padman ..	" " .	1,222	28	6 6 1¼	23 1	2,352¾
8	D. Fisher ..	Black Orpington	1,023	58	5 11 3	24·8	2,110
9	J. S. Spotswood ..	White Leghorn ..	1,268	21	6 11 7¼	24 33	2,571½
10	S. P. Giles ..	R.C. Brown Leghorn	1,201	34	5 18 4¾	23 51	2,353½
11	T. S. Goodisson ..	Black Orpington	1,060	53	5 0 0½	25·08	2 218½
12	T. H. C. Stafford	White Leghorn ..	1,149	41	5 13 1	24·35	2,338¾
13	W. B. Crellin ..	" " ..	1,296	15	6 9 8½	24·5	2,646¼
14	J. H. Wright ..	" " ..	1,212	30	6 2 2¼	24·22	2,446¾
15	Mrs. W. H. Steer	" " ..	1,143	42	5 15 3¼	26·18	2,494¼
16	R. Jobling ..	Silver Wyandotte	1,129	45	5 12 8	23·53	2,197½
17	S. Childs ..	White Leghorn .	918	66	4 4 1¼	24·72	1,975
18	B. Mitchell ..	" " ..	895	69	4 8 10½	25·71	1,901
19	Cowan Bros. ..	" " ..	1,205	32	6 1 0¼	24·27	2,438¼
20	E. Waldon ..	" " ..	1,413	3	7 6 9¼	25·4	2,831
21	J. O'Loughlin ..	" " .	990	60	4 15 5¾	26 82	2,213½
22	W. N. Ling ..	" " .	933	61	4 8 11¾	26 23	2,039¾
23	W. McLister ..	" " ..	1,363	4	7 4 0	24·04	2,731¼
24	C. J. Chandler ..	" " ..	1,238	27	6 7 0½	25·07	2,587
25	R. L. Appleford ..	" " ..	1,362	5	6 18 6¼	23·76	2,695¾
26	(Reserved)						
27	E. C. Nash ..	White Leghorn ..	1,052	54	5 4 1¾	25·81	2,263
28	F. G. Eagleton ..	" " ..	1,348	9	7 1 1¼	24·25	2,725¼
29	J. B. Brigden ..	" " ..	1,253	23	6 7 11¼	21·45	2,240½
30	Mrs. H. Stevenson	" " ..	1,079	50	5 11 11	25 61	2,303½
31	George Edwards ..	" " ..	1,349	8	7 0 7¾	25·0	2,811½
32	S. Brundrett ..	" " ..	1,204	33	5 16 0¾	25·32	2,541½
33	H. McKenzie ..	" " ..	1,362	5	6 17 9¾	23·82	2,704¼
34	R. F. B. Moore ..	" " .	913	67	4 4 2	26 37	2,007¼
35	C. H. Busst ..	" " .	1,167	37	5 17 8¼	25·35	2,460
36	K. J. Barrett ..	Old English Game	902	68	4 7 9¼	21·88	1,648¼
37	C. B. Bertesimeier	White Leghorn ..	1,274	20	6 9 2	24 17	2,567½
38	R. Moy ..	" " ..	1,275	19	6 10 8	24 77	2,631¾
39	W. G. Swift ..	" " ..	1,334	10	6 16 6	24·44	2,718¾
40	S. Brown ..	" " ..	1,468	1	7 14 4	24·84	3,043½
41	A. Stringer ..	" " ..	1,028	57	5 0 0	24·61	2,109¼
42	Mrs. T. E. Kempster	" " ..	1,159	38	5 16 6¼	25·48	2,462¼
43	G. Purton ..	" " ..	1,123	46	5 11 4½	25·78	2,413½
44	A. W. Hall ..	" " ..	1,264	22	6 10 2¾	24·7	2,602
45	Wooldridge Bros.	" " ..	1,328	11	6 16 0¾	24·01	2,656¾
46	H. A. Langdon ..	Black Orpington	1,245	24	6 11 1¼	23 57	2,446
47	J. E. Bradley ..	White Leghorn ..	1,454	2	7 12 1¾	25·55	3,096¼
48	Griffin Gant ..	" " ..	1,243	25	6 9 6¾	24·04	2,491¼
49	W. Purvis ..	" " ..	1,292	16	6 10 10¼	23·11	2,488¼
50	A. Ahpee ..	" " ..	1,218	29	6 4 11	25·11	2,548¾
51	H. Hammill ..	" " ..	1,151	40	5 14 2½	24·68	2,368½
52	Chalmers Bros. ..	Black Minorcas ..	929	64	4 2 0½	29·23	2,262¾
53	H. Hodges ..	White Leghorn ..	1,279	18	6 7 6¼	24·59	2,620¾
54	F. R. DeGaris ..	" " ..	1,078	51	5 7 1½	27·8	2,498½
55	Jas. Matheson ..	Brown Leghorn ..	1,088	49	5 5 7	24·54	2,226¼
56	M. A. Monk ..	White Leghorn ..	1,096	48	5 10 4	25·55	2,334¼
57	B. Walker ..	" " ..	1,139	43	5 11 5¼	24·51	2,327½
58	W. J. Stock ..	" " ..	931	62	4 12 6¾	23·0	1,784¾
59	W. Seabridge ..	" " ..	922	65	4 8 5½	26·08	2,004
60	Miss B. E. Ryan	" " ..	1,078	51	5 6 0	24·66	2,216½
61	Jas. Ogden ..	Black Orpington	1,242	26	6 4 2	28·2	2,402¼
62	R. W. Pope ..	White Leghorn ..	1,311	13	6 13 10½	23·76	2,594¼
63	Percy Walker ..	" " ..	1,283	17	6 10 3¾	24·91	2,663½
64	H. Merrick ..	" " ..	1,158	39	5 15 10¾	25·25	2,436¾
65	A. Thompson ..	" " ..	1,118	47	5 9 4½	25·37	2,364¼
66	J. Moloney ..	" " ..	1,052	54	4 19 9	26·16	2,297
67	A. E. Manning ..	Ancona	931	62	4 6 3½	24·06	1,949¾
68	W. J. McKeddie	White Leghorn ..	992	59	4 15 4½	24·27	2,007¼
69	Morgan and Watson	" " ..	1,196	35	5 15 7	25·24	2,516½
70	C. J. Beatty ..	" " ..	1,353	7	7 8 7½	26·92	3,036½
		Totals ..	80,865	..	406 12 6	..	..

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Manuring.

The expediency of adding food supplies to the soil will now come under the consideration of the fruit-grower. It is not wise to recommend any general manure, as soil and climatic conditions vary considerably throughout the State. Humus in the form of any decayed animal or vegetable matter may now be added, and it will prove beneficial and reproductive. Lime may also be applied at this time. The dominant influence of lime will always be felt in a beneficial manner in orchards, provided it be not used too frequently.

It is far more important, however that the soil be placed in a perfect physical condition by draining, subsoiling, and thorough cultivation, so that the tree roots may derive the greatest possible benefit from the soil itself. Then, when that is done, the grower may turn to soil additions as a further means of increasing his yield.

Manuring, except with quick-acting manures such as nitrate of soda and potash and sulphate of ammonia, should be carried out in the autumn, and preferably before the autumn ploughing. There are several methods by which the soil may be enriched for orchard trees; humus may be added in the form of animal manures, green manures, plant or animal refuse; the trees may be stimulated by a chemical plant food; or the food in the soil may be released by the application of lime in one of its many forms. Whatever method is selected, it is wise to adopt a regular system of rotation, so that the soil may be assisted and enriched in a different manner each year, and so that it may not be over-stocked with any one particular form of tree food.

Pests.

Orchards will benefit if an attack is now made upon the codlin moth. All hiding places, nooks and crannies, wherever the larvæ have hidden, should be thoroughly searched and cleaned out. The orchardist has far more time now to do this work than he will have in the springtime.

It is now a favorable time to spray the trees where such pests as Bryobia mite, woolly aphis, scale species, and peach aphis have been or are prevalent.

Any of the recognised sprays are suitable, these being red oil, crude petroleum, kerosene emulsion, or lime-sulphur wash. The latter wash is again becoming popular, partly owing to its effectiveness, and also to its possessing certain properties as a fungicide.

Flower Garden.

The month of May is a suitable one for the preparation of new flower beds. In starting on this important work, the first essential

is good drainage. The fertility of the soil depends so much on its ability to free itself of all surplus and unnecessary water by being in a good mechanical condition. This is of far greater importance than increasing the value of the soil by the addition of organic manures. The latter is by no means to be despised, but a correct condition with good drainage is the first necessity.

The new beds should be well trenched into the clay, or the subsoil. It is not advocated that the trenching shall be excessively deep. Much labour has been lost in the past by deep trenching, and no very definite results have been produced.

The subsoil surface should be trenched so that the soil moisture may soak into it, and so that the plant roots may be able to penetrate into the subsoil. Then the surface soil and loam should be thoroughly cultivated and broken up. These remarks apply especially to the preparation of rose beds. If new ground is being broken up, the addition of from 4 to 5 cwt. of lime will be a distinct advantage. The lime should be well worked into the soil. The addition of stable manures to the soil may now be carried out. Too heavy dressings are not advised, as an accumulation of manure in the soil is likely to set up sour and unhealthy conditions. The manure should be thoroughly mixed with the soil.

It is not too late to sow sweet pea seeds, but the best results come from early planting. The planting of these seeds should not be delayed. Better results will be obtained if the seeds are sown in boxes, pots, or seed beds, and planted out when the young plants are 2 or 3 inches high. The crown should be pinched out at transplanting, so that the plant will "stool" or branch out better.

At the end of the month a start may be made with the autumn digging, pruning, and clearing up. Manure may be dug into the beds, well below the surface. All leaves and light litter should also be dug in. If necessary, a light top dressing of lime may be given after the digging has been completed.

As much garden litter as can be saved should be rotted down for future use; the rough litter and strong stems should be burned, and the ashes returned to the soil.

Flowering shrubs should be pruned only after flowering season of each plant has passed.

By this time all bulbs and tubers for spring flowering will be planted, and in many instances these are above ground. They should be protected from the ravages of slugs, snails, and other pests. Summer flowering bulbs and allied plants, such as iris and lilium, may now be planted.

Chrysanthemums, delphiniums, dahlias, perennial phlox, polygonum, and other herbaceous perennials may now be cut down, and if necessary lifted for storing

Rose cuttings may now be planted, and Iceland poppies and pansies should be planted out from the seed beds.

Vegetable Garden.

The remarks in the flower garden notes referring to preparation of new beds also apply to the kitchen section; this being the time for good soil work. Only where deep-rooting vegetables are to be grown,

such as carrots and turnips, the soil and subsoil should be deeply worked so as to allow a ready root run for these vegetables.

A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimize future attacks of insect and fungus pests.

All asparagus plots should be cleaned out, cut down, and kept in good order. A light dressing of stable manure may be given to the beds.

Plantings may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, &c.; and seeds of carrot, leek, lettuce, onion, peas, radish, turnip, parsnip, broad beans, &c., may be sown.

STATISTICS.

The Victorian Wheat Harvest.

Mr. A. M. Laughton, Government Statist, has issued the following return, showing the actual area under crop and the yield of wheat for the seasons 1911-12 and 1912-13:—

Counties Geographically Arranged	Area in Acres.		Produce in Bushels.		Average per Acre in Bushels.	
	1911-12	1912-13	1911-12.	1912-13.	1911-12	1912-13.
Grant	17,565	12,418	183,982	207,918	10·47	16·74
Talbot	14,751	11,973	162,168	196,709	10·99	16·43
Grenville ..	43,657	40,443	516,402	789,824	11·83	19·53
Hampden ..	20,333	24,045	195,258	463,289	9·60	19·27
Ripon	68,162	83,636	554,715	1,669,259	8·14	19·96
Lowan	160,384	143,314	1,592,602	1,962,154	9·93	13·69
Borung	315,468	274,956	3,760,294	4,072,629	11·92	14·81
Kara Kara ..	127,289	114,260	1,541,418	1,679,804	12·11	14.70
Weeah	66,332	91,188	328,113	914,922	4·95	10·03
Karkarooc ..	332,984	376,389	1,943,436	2,851,867	5·84	7·58
Tatchera ..	217,603	236,672	1,410,192	1,664,955	6·48	7·03
Gunbower ..	38,351	35,888	380,245	378,181	9·91	10·54
Gladstone ..	122,830	100,424	1,428,613	1,305,528	11·63	13·00
Bendigo ..	128,601	117,363	1,571,500	1,686,702	12·22	14·37
Rodney ..	124,905	115,776	1,436,022	1,690,814	11·50	14·60
Moira	279,761	229,836	3,028,612	3,337,746	10·83	14·52
Delatite.. ..	12,316	11,986	123,713	234,018	10·04	19·52
Bogong ..	41,714	35,595	400,242	571,526	9·59	16·06
Remainng counties	31,060	29,054	334,350	545,259	10·76	18·77
Cut for grain ..	2,164,066	2,085,216	..	..	..	..
Cut for hay ..	304,388	386,370	..	..	..	..
Total ..	2,468,454	2,471,586	20,891,877	26,223,104	9·65	12·58

Note.—The requirements for seed and consumption in 1913 are estimated at 9,000,000 bushels.

Rainfall in Victoria.—First Quarter, 1913.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with the corresponding monthly and quarterly averages for each Basin, deduced from all the available records to date.

Basin or District.	January.		February.		March.		Quarter.	
	Total.	Average.	Total.	Average.	Total.	Average.	Total.	Average.
	points.	points.	points.	points.	points.	points	points.	points.
Glenelg and Wannon Rivers	40	115	127	110	306	168	473	393
Fitzroy, Eumerella, and Merri Rivers	57	137	113	181	363	186	533	504
Hopkins River and Mount Emu Creek	45	139	166	132	342	190	553	461
Mount Elephant and Lake Corangamite	35	144	212	125	479	202	726	471
Cape Otway Forest ...	83	202	137	170	627	290	847	662
Moorabool and Barwon Rivers	33	143	165	130	637	203	835	476
Werribee and Saltwater Rivers	26	144	89	146	597	215	712	503
Yarra River and Dandenong Creek	63	222	110	192	644	306	817	720
Koo-wee-rup Swamp ...	46	233	103	166	720	296	869	695
South Gippsland	78	235	93	175	686	328	857	736
Latrobe and Thomson Rivers	77	241	144	173	697	297	918	711
Macallister and Avon Rivers	44	183	76	150	778	217	898	550
Mitchell River	35	268	71	217	766	235	872	720
Tambo and Nicholson Rivers	34	235	85	171	810	300	929	706
Snowy River	72	303	151	223	9[illegible]0	299	1,153	825
Murray River	102	119	87	119	450	164	639	402
Mitta Mitta and Kiewa Rivers	179	178	131	161	787	307	1,097	646
Ovens River	185	180	148	161	608	286	941	627
Goulburn River	79	141	126	120	488	185	693	446
Campaspe River	20	116	152	133	422	168	594	417
Loddon River	12	93	139	112	378	132	529	337
Avon and Richardson Rivers	3	68	61	96	245	115	309	279
Avoca River	6	69	93	89	277	126	376	284
Eastern Wimmera	9	81	138	115	227	152	374	348
Western Wimmera	12	63	162	82	1[illegible]2	112	326	257
Mallee District	10	55	55	89	304	99	369	243
The whole State	48	136	116	128	550	184	714	448

N.B.—100 points = 1 inch.

H. A. HUNT,

Commonwealth Meteorologist

Perishable and Frozen Produce.

Description of Produce.		Exports from State.		Deliveries from Government Cool Stores	
		Quarter ended 31.3.13.	Quarter ended 31.3.12.	Quarter ended 31.3.13.	Quarter ended 31.3.12.
Butter	lbs.	9,044,252	12,066,660	9,783.872	13,309,016
Milk (dried) ...	cases	2,171	1,203	.	...
Milk (concd.) .. .	"	1,032	2,899	..	10
Cheese	lbs.	30,600	34,440	21,240	17,850
Ham and Bacon ...	"	8,640	102,720	...	.
Poultry	head	2,130	4,170	182	2,923
Eggs...	dozen	...	..	2,724	8,182
Mutton and Lamb	carcases	380,817	436,564	3,913	13,078
Beef	quarters	12,732	8,041	284	232
Veal	carcases	930	1,075	13	13
Pork...	"	.	2,319	156	1,134
Rabbits and Hares ...	pairs	272,904	155 676	151,063	86,984
Sundries ...	lbs.		...	63,675	24,393

R. CROWE, *Exports Superintendent.*

Fruit, Plants, Bulbs, Grain, &c.

Imports and Exports Inspected for Quarter ending 31/3/13.

Description of Goods	Imports. Inter-State.	Imports. Oversea.	Exports. Oversea.	Description of Goods.	Imports. Inter-State.	Imports. Oversea.	Exports. Oversea.
Apples ..	415	—	235,548	Logs ...	29	2,502	—
Apricots . ..	1,621	—	28	Linseed ...	—	210	-
Bananas, bunches	56,337	19,612		Mangoes . . .	14	—	—
Bananas, cases ..	5,523	15,049	—	Melons	4		—
Barley	123,863	9,197	—	Nutmegs ..	-	242	—
Beans	84	791	—	Nuts	102	3,217	—
Blackberries ...	466	—	—	Oats	6,890	1,394	—
Black Currants ...	241	—	—	Onions	176	—	—
Bulbs	20	160	22	Oranges	27,454	7,684	—
Cherries	2	—	165	Passion Fruit ...	824	—	—
Chillies	—	211	—	Peaches	3	—	79
Cocoa beans ..	—	806	—	Pears	4	—	40,683
Cocoanuts . .	171	—	—	Peas, dried ...	1,053	185	—
Coffee beans .	—	1,041	—	Pepper	—	171	—
Copra	—	1,267	—	Persimmons ...	99	—	—
Cucumbers ...	132		—	Pineapples .	22,363	—	361
Dates	—	6,705	—	Plants, Trees, &c...	68	363	3
Fruit—				Plums	4	—	660
Canned ...	—	—	1,871	Potatoes .	23	1	1,693
Dried ..	1	1,520	188	Quinces	—	-	40
Mixed ..	19	172		Raspberries ...	46		—
Grapes	7	—	106	Rice . ..	4,078	19,360	—
Gooseberries ...	101	—	—	Seeds	1,461	12,156	46
Green Ginger ...	—	791	—	Spice	—	211	—
Hay	—	75	—	Tomatoes ..	336	—	32
Hops		1,415	—	Vegetables ..	564	284	—
Jams, Sauces, &c...	—	—	1,020	Wheat, Grain, &c...	223	30	—
Lemons ..	—	7,671	—	Yams	6	4	—
Lentils ...	—	79	—				
				Grand Totals ...	254,827	114,576	282,545

Total number of packages inspected for quarter ending 31st March, 1913 = 651,948.

E. MEEKING, *Senior Fruit Inspector.*

REMINDERS FOR JUNE.

LIVE STOCK.

HORSES.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley.

CATTLE.—Cows, if not housed, should be rugged. Rugs should be removed in the daytime when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows about to calve, if over fat, should be put into a paddock in which the feed is not too abundant. Calves should be kept in warm dry shed. Cows and heifers for early autumn calving may be put to the bull.

PIGS.—Supply plenty of bedding in warm, well-ventilated styes. Keep styes clean and dry. Store pigs should be placed in fattening styes. Sows in fine weather should be given a grass run. Young pigs over two months old should be removed from lucerne run.

SHEEP.—Feed being plentiful, ewes should mother their lambs well. Lambs and dry ewes should therefore be in good order and sell well during the winter. Lambs born early from roomy merino ewes (especially if by good Leicester rams) should soon be ready in northern areas and sell well from now on, when up to 45 to 50 pounds live weight. Maintain supply of milk producing grass for all ewes with lambs, this being a most critical stage.

POULTRY.—Forward pullets should now be placed in winter scratching shed, fed liberally, and given fresh water daily. Supplies of shell, grit, and charcoal should always be available. Rest the breeding pens; dig them up and sprinkle lime throughout. Sow a mixture of English grass and clover; this not only removes taint in soil, but provides excellent green fodder for stock. Where possible, lucerne should now be sown for summer feed. Meat (cooked) and maize are aids to egg production during cold weather. Feed hot mash at daybreak. Clean drains.

CULTIVATION.

FARMS.—Plough potato land. Land to be sown later on with potatoes, mangolds, maize, and millet should be manured and well worked. Sow malting barley and finish sowing of cereals. Lift and store mangolds, turnips, &c. Clean out drains and water furrows. Clean up and stack manure in heaps protected from the weather.

ORCHARD.—Finish ploughing; plant young trees; spray with red oil or petroleum for scales, mites, aphis, &c.; carry out drainage system; clean out drains; commence pruning.

VEGETABLE GARDEN.—Prepare beds for crops; cultivate deeply; practise rotation in planting out; renovate asparagus beds; plant out all seedlings; sow radish, peas, broad beans, leeks, spinach, lettuce, carrot, &c.; plant rhubarb.

FLOWER GARDEN.—Continue digging and manuring; dig all weeds and leafy growths; plant out shrubs, roses, &c.; plant rose cuttings; prune deciduous trees and shrubs; sow sweet peas and plant out seedlings.

VINEYARD.—Thoroughly prepare for plantation land already subsoiled for the purpose. Remember that the freer it is kept from weeds from this forward, the less trouble will there be from cut-worms next spring. Pruning and ploughing should be actively proceeded with. In northern districts plough to a depth of seven or eight inches. Manures should be applied as early as possible.

Cellar.—Rack all wines which have not been previously dealt with. Fortify sweet wines to full strength.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 6. 10th June, 1913.

THE PIG INDUSTRY.

(*Continued from page 255, Vol. X.*)

By R. T. Archer, Senior Dairy Inspector.

IV.—FATTENING PIGS.

The system of feeding the sow has already been dealt with.* We have now to consider the best method of producing pork or bacon of a quality that will command the best class of trade, at the same time having due regard to the economical aspect of the business which alone will enable us to derive profit from the undertaking.

The object of feeding pigs is to convert forage into palatable and nourishing food of the highest quality for man in the most economical manner. The quality must be such that it will suit the highest class of trade, where the highest prices are paid for a suitable article. This alone will make the industry remunerative. Formerly, the popular taste was for a heavy weight fat bacon, but during the last twenty years the taste has undergone a considerable change, as at the present time what is in greatest demand is a young, lean, juicy, sweet, mild-cured bacon. Fortunately for the producer also this class of product is the most economical and remunerative to provide, for the young pig has greater powers of digestion and assimilation; and while a young pig will be able to produce a pound of green pork out of about 4 lbs. of food, a fully-matured animal or backfatter may take 6 lbs. or more. So that, taking pollard at 1s. per bushel, or .6 of a penny per lb., in a young pig the pork would cost for feed 2½d. per lb; while a backfatter, taking 6 lbs. of pollard to 1 lb. of meat, would cost 3½d. In the former case it may be safely reckoned that 4d. per lb. on an average will be realized, while for the latter only 2½d. to 3d. will be returned.

In addition to cost of food there are other expenses to be considered, which may be put at ½d. per lb.

---

* *Journal of Agriculture*, Vict., April, 1912.

FEEDING.

The pig is the most economical meat producer of all farm stock, *i.e.*, it produces more meat for the amount of food consumed than any other animal. This is illustrated by the following figures:—

GRAIN REQUIRED FOR 100 LBS. OF LIVE WEIGHT GAINED.

—	Barley	Maize.	Oats	Pease.	Wheat.
Pigs	418	485	472	439	452
Sheep	453	502	518	522	582
Cattle	914	1,028	1,032	911	1,090

AMOUNT OF PORK PRODUCED PER ACRE FROM VARIOUS CROPS.

—	Bushels per acre.	Pounds of Grain.	Grain per lb. of Meat.	Pork per Acre.	—
					£ s. d.
Wheat	15 (60 lbs.)	900	5	180 @ 4d.	= 3 0 0
Barley .. .	35 (50 lbs.)	1,750	5	350 ..	= 5 16 0
Oats	40 (40 lbs.)	1,600	5	320 ,,	5 6 8
Maize	40 (56 lbs.)	2,240	5	440 ,,	7 9 4
Pease . ..	25 (60 lbs.)	1,500	5	300 ..	= 5 0 0
Green clover ..	5½ tons	= 12,320	15	821 ,,	=13 13 8
Green lucerne ..	3 ,,	= 6,720	15	448 ..	- -
Green lucerne (4 cuts) =	12 ,,	= 26,880	15	1,792 ,,	29 14 0

AVERAGE BIRTH WEIGHT AND WEEKLY GAINS OF PIGS BEFORE AND AFTER WEANING.

Before Weaning, 10 weeks, average of 12 Litters, 86 pigs.			After Weaning, 7 weeks, average of 8 Litters, 62 pigs.		
Week.	Average Weight.	Gain.	Week.	Average Weight.	Gain.
	lbs.	lbs.		lbs.	lbs.
At birth	2·5	..	..	..	..
1	4·4	1·9	10	41·5	..
2	7·0	2·6	11	46·7	5·2
3	9·8	2·8	12	52·0	5·3
4	12·5	2·7	13	58·3	6·3
5	15·6	3·1	14	64·2	5·9
6	18·6	3·0	15	69·8	5·6
7	22·6	4·0	16	76·5	6·7
8	27·8	5·0	17	84·1	7·6
9	33·1	5·3	..	..	..
10	38·5	5·4	..	..	..

The heaviest pig in these litters weighed 3.6 lbs. at birth, and the lightest 1.6 lb.; the average for the lot being 2.5 lbs. During the first week after birth the pigs made a gain of 1.9, or an increase of 76 per cent. The tenth week showed a gain of 5.4 lbs., equal to 14 per cent. For the seventeenth week there was a gain of 7.6 lbs., or 6.3 per cent.

WEEKLY GAINS OF PIGS FROM BIRTH TO MATURITY.—WISCONSIN STATION.

Age or Weight of Pigs.	Weight of Pigs.	Gain in 7 Days.
	lbs.	Per cent.
At birth	2·5	..
First week	4·4	76
Second week	7·0	59
Third week	9·8	40
Fourth week	12·5	28
Fifth week	15·6	25
Sixth week	18·6	19
Seventh week	22·6	22
Eighth week	27·8	23
Ninth week	33·1	19
Tenth week	38·5	16
Under 100 pounds	78	7·0
„ 150 „	128	6·0
„ 200 „	174	5·0
„ 250 „	226	4·1
„ 300 „	271	3·8
„ 350 „	320	3·1

As showing the increased cost per pound of gain with the increase of weight, Professor Henry gives the following table, which is the result of feeding over 2,200 pigs:—

Weight of Pigs.	Average Feed per Day.	Feed eaten Daily per 100 lb Live Weight.	Average Gain per Day.	Feed eaten for each 100 lbs. of Gain.	Cost per lb. with Pollard at 1s. per Bushel.	
					Live Weight.	Carcase.
lbs.	lbs.	lbs.	lbs.	lbs.	Pence per lb.	Pence per lb.
15–50 ..	0·223	5·95	0·76	293	1·758	2·197
50–100 ..	3·35	4·32	·83	400	2·40	3·0
100–150 ..	4·79	3·75	1·10	437	2·62	3·37
150–200 ..	5·91	3·43	1·24	482	2·89	3·61
200–250 ..	6·57	2·91	1·33	498	2·98	3·73
250–300 ..	7·40	2·74	1·46	511	3·06	3·82
300–350 ..	7·50	2·35	1·40	535	3·21	4·01

PREPARATION OF THE FOOD.

Cooking Feed for Pigs.

Henry says:—"While the practice of steaming roughage for cattle has been universally abandoned wherever undertaken, much is still said concerning the advantages of cooking feed for swine. This subject has been carefully investigated at our stations with practically concordant results, so that we are not without definite help on an important topic."

A great number of experiments have been conducted to determine the value of cooking the feed for pigs, the results being almost without exception in favour of not cooking. Including all the tests, so far as

known, the average shows that 476 lbs. of uncooked meal or grain were required for 100 lbs. of pork; while after it was cooked 505 lbs. were required. This shows a loss of 6 per cent. of the feeding value through cooking.

Soaking Meal versus *Dry Meal.*

Comparing the value of feeding meal or grain soaked with water as against the same feed dry, 451 lbs. of soaked food was equal in feeding value to 483 lbs. of dry grain or meal; a difference of 7 per cent. in favour of soaking. That will show 13 per cent. in favour of soaking over cooking.

Mixing the Feed.

It has been found that by mixing two or more grain feeds, the amount required for pork production is reduced by 20 per cent. The greater the variety the better the result.

THE VALUE OF SHELTER.

In testing the value of shelter in pig feeding it was found that those kept in an open yard required 117 lbs., or 25 per cent. more corn for every 100 lbs. gain, than those given shelter.

It is estimated that the maintenance requirement of the pig is about 2 lbs. of feed equal to pollard for every 100 lbs. live weight, and it is only what they eat above that amount that they can convert into meat. Provided they are properly bred, the more they can be persuaded to eat in 24 hours the more profitable they are.

EXERCISE.

The results of tests extending over four years, comparing the feeding of pigs kept in small pens and allowing exercise in yards or run of pastures show that those in pens or sties averaged a daily increase of weight of .9 lb., requiring 512 lbs. of feed for every 100 lbs. of increase; while those allowed a run increased at the rate of 1.1 lb. daily at a cost of only 420 lbs. of feed for 100 lbs. increase.

This shows .2 of a lb. greater daily gain, and a saving of 92 lbs. of grain or 18 per cent. of the feed in making 100 lbs. of pork in favour of yard or pasture over close confinement.

The Canadian system is generally to let them run on grass while fattening. Experiments recently conducted on an extensive scale at the Illinois Experiment Station—thirteen experiments with 618 pigs—prove that young and growing pigs require plenty of exercise. This appears to have its chief value in its influence over the respiratory and digestive organs. When changed from a place where they have plenty of exercise to where they have little room, they eat less, and the result is smaller and usually more expensive gains.

WATER.

It has been mentioned that the food for fattening pigs should not be fed in a sloppy condition, but about the consistency of oatmeal porridge. Careful investigation goes to show that the proper proportion of water to feed is about 3 to 1.

At the Yorkshire College Farm two pens of six each were fed equal parts of barley-meal and pollard. In one case the mixture was

soaked with four times its weight of water, while in the other only twice its weight of water was used. The former was fed in a sloppy condition, the latter was of the consistency of oatmeal porridge. Both lots were allowed as much food as they would eat, and those having the drier food had access to a water trough. In eight weeks the pigs getting the wetter feed increased by 334 lbs., while the other gained 458 lbs. (live weight). The pigs of the former consumed 1,904 lbs. of food, while those of the latter ate 2,254 lbs. The proportions of food consumed to weight gained were—

In those getting much water	5·7
In those getting less water	4·9

The pigs fed on the drier food thus made 124 lbs. more increase in live weight, and yielded about 102 lbs. more pork; while each 1 lb. of increase in live weight was obtained by the expenditure of .8 of 1 lb. of feed less than with the other animals, equal to ½d. per lb. The extra cost of food was about 19s., but the value of the increased quantity of pork was about 42s. 6d., leaving a net gain of 23s. 6d. for the pen receiving the drier food. The extensive feeding experiments conducted by Harris for the Wiltshire County Council prove also that 3 lbs. of water or 3 lbs. of skim milk to 1 lb. of meal are the best proportions.

A plentiful supply of water should always be provided for pigs to drink; and also, where possible, to wallow in, particularly in hot weather. These animals are often severely affected by heat, and on hot days a careful watch should be kept to see that they are not suffering. If they are, they should be well doused with water.

FEED.

Peas.—This feed is rich in protein, and consequently good for young pigs and production of lean bacon. If fed whole, they are very palatable, but a big percentage is wasted, passing through the system undigested. Pea-meal is a valuable feed but should never be fed alone; its close heavy nature renders it difficult to digest, and the pigs are apt to sicken. It combines well with barley or barley and pollard. A few well-ground oats may also be added.

Beans.—While this grain is rich in protein, and will be valuable in enriching the ration in this requirement, if fed in any considerable quantity has the undesirable result in producing soft bacon—one of the worst of faults. When available, it should be fed in conjunction with other grain. It is a valuable crop to grow, however, as very heavy yields can be obtained.

Barley.—It may be safely said that this is the best of all the grain feeds for the production of bacon, taking into consideration both quantity and quality. It should always be crushed, and for young pigs should be mixed with pollard, a little barley meal to commence with, and gradually increasing the proportion.

Wheat.—This is a valuable feed for bacon, and would often give better returns when converted into pork than sold in its natural condition. As 5 lbs. of wheat will produce 1 lb. of pork, on an average, 1 bushel of 60 lbs. will produce 12 lbs. of pork, at 4d. gives 4s. per bushel for the wheat; or, deducting ½d. per 1 lb. for working expenses, would return 3s. 6d. net for wheat. Split or damaged wheat may be

turned into profit in this way; and when market rates are below the price indicated, the above profit may be derived by converting it into pigs.

Rye.—This has a little lower feeding value than wheat. When compared with barley, it will produce about the same quantity, but the quality will be inferior, and it should be fed in conjunction with other food.

Oats.—Where oats are largely used for pigs the husks are removed, and then they are excellent feed both for quality and quantity. They are of too fibrous a nature for young and fattening pigs, although a little crushed fine may be mixed with other food. The famous York hams are supposed to owe much of their excellent flavour to the fact that the pigs are largely fed on oatmeal.

Oat Branning is generally cheap, and, being palatable and rich in protein, may be used with advantage.

Pollard.—This is an excellent food for pigs of all ages and for all purposes. It has the reputation of producing bacon of rather a soft nature, and consequently should be fed with some other grain. When fed with skim milk it gives very satisfactory returns.

Oil Cakes are expensive, and have not been found very satisfactory for pig feeding, so we may leave them out of consideration.

Bran, although rich in protein, must not be looked upon as a fattening food, while it is a very good milk producer, fed to the suckling sow. The principal value of bran is medicinal, helping to keep the bowels regular. A careful watch must be kept to see that pigs do not become constipated, as this quickly leads to or is indicative of serious trouble if not corrected. Bran in the food is very valuable for this purpose.

Maize.—In America, where maize is very cheap, it is largely fed to pigs, and produces a large weight of meat for the amount consumed. In this country also in those districts where maize is grown extensively, and owing to distance from railway communication, and consequent difficulty in getting it to market, it is very largely converted into pork. When fed in large quantities the quality of the flesh is inferior, being soft, oily, and not a good colour. When fed sparingly, however, together with other grain, such as barley, pollard, and skim milk and potatoes, the results are satisfactory. Maize on the market is seldom very low in this country, and generally other grain foods are more economical. In the East Gippsland river flats, where usually from 80 to 100 bushels per acre of maize is grown, and it takes about 5 lbs. to produce 1 lb. of pork, about 1,000 lbs. per acre would be produced, which at 4d. per lb. amounts to £16 13s. per acre.

Maize is not good food for young pigs if fed by itself or in any quantity. It is very deficient in mineral matter, of which young pigs are not able to extract sufficient to build up the necessary bone structure. Henry gives results of tests illustrating this where pigs fed on maize lacked density of bone to such an extent that the breaking strength of the thigh bone was only 380 lbs., while at the same time that of pigs fed on milk, blood, and pollard was 503, a difference of 32 per cent. Maize-meal fed by itself is close, heavy, and difficult to digest.

Maize Corn and Cob Meal.—While the maize cob itself is highly fibrous and innutritious, it becomes a valuable food when ground into

meal together with the grain, and owing to its mechanical effect in lightening the maize meal it increases its digestibility. This is a method of converting a waste product into a valuable food. In the maize-growing districts tons of cobs may be seen either burning or left to rot. Machines for grinding the corn and cob are now on the market.

Malt Coombs, or the sprouts from malt, is very rich in protein, and sweet. It may be mixed with other feed, and as it is generally cheap will have the effect of both enriching and reducing the cost of feed.

Rice Meal is a feed largely used in Britain, but seldom heard of here. It is fairly rich in protein and phosphoric acid, and may be considered equal to barley. It should be mixed with some other food.

Separator Skim Milk.—The pig will give the best returns for the by-products of the dairy if these are fed in a proper manner. To obtain full returns, however, it should be fed in conjunction with grain, &c. The tables given below ilustrate clearly how milk should be fed to secure the best results.

At the Wisconsin Experiment Station, Professor Henry conducted nineteen trials with 88 pigs of all ages, to determine the value of separator milk in combination with maize meal. The proportion of milk to meal varied from 1 lb. to 9 lbs. of milk for each 1 lb. of meal fed, and the following table clearly shows the result:—

Separator Skim Milk and Maize Meal required for 100 lbs. of Gain.

When Feeding.	Number of Trials.	Feed for 100 lbs. of Gain.	
		Meal.	Milk.
1 lb. of Corn-meal to 1 to 3 lbs. skim milk ..	3	321	585
1 lb. ,, 3 to 5 lbs. ,, ..	8	265	1·048
1 lb. ,, 5 to 7 lbs. ,, ..	5	250	1·434
1 lb. ,, 7 to 9 lbs. ,, ..	3	207	1·616

Assuming that 500 lbs. of maize-meal fed alone would have produced 100 lbs. of pork (the average of a number of trials was 532), we find that with the first group 585 lbs. of skim milk effected a saving of 179 lbs. of maize-meal. On this basis, 327 lbs. of skim milk is equal to 100 lbs. of maize-meal, when fed in the proportion of not exceeding 3 lbs. of milk to 1 lb. of meal. Taking maize-meal as a standard, we find the values of skim milk, when fed with maize-meal, in the varying proportion as follow:—

Meal Saved by Milk Fed in Varying Proportions.

When Fed in Proportion of—	lbs. Milk.	Saves lbs. Meal.
1 lb. Maize-meal to 1 to 3 lbs. separator milk	327	100
1 lb. ,, 3 to 5 lbs. ,, ...	446	100
1 lb. ,, 5 to 7 lbs. ,, ...	574	100
1 lb. ,, 7 to 9 lbs. ,, ...	552	100

The average of all:—475 lbs. skim milk equals 100 lbs. maize-meal. This places a money value on separator skim milk. The following table shows at a glance the comparative value of separator milk when fed to pigs, combined with meal, in different proportions and prices:—

Price of Maize.	Value of 100 lbs. of Skim Milk. When Feeding—1–3 lbs. of Milk to 1 lb. of Maize-meal.	Value of 100 lbs. of Skim Milk. When Feeding—7–9 lbs. of Milk to 1 lb. of Maize-meal.	Average of all Trials.
s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
1 2 per bushel	0 7½	0 4½	0 5½
1 4¾ „	0 9	0 5½	0 6½
1 7½ „	0 10½	0 6½	0 7½
1 10½ „	1 0	0 7½	0 8½
2 1½ „	1 2	0 8	0 9½
2 4 „	1 3½	0 9	0 10½
3 6 „	1 11	1 1½	1 4

This table shows that when maize is worth 1s. 2d. per bushel, separator milk is worth, for pig feeding, 7½d. per 100 lbs., provided that not more than 3 lbs. of skim milk are fed with each 1 lb. of meal. If, however, 9 lbs, of milk be fed with each 1 lb. of meal, the milk is worth only 4½d. per 100 lbs., and the average value is 5½d. Again, the value of the milk increases in proportion as does the price of meal. So that when maize is worth 3s. 6d. per bushel, 10 gallons of skim milk is worth 1s. 11d., if fed in proportion of not exceeding 3 lbs. of milk to 1 lb. of meal. This shows the value of separator skim milk for production of pork or bacon. The Danes place the value at 6 lbs. of milk equal to 1 lb. of meal. Separator milk is all digestible, it is rich in protein or nitrogenous matter, which is responsible for the production of lean meat and also bone, so being particularly valuable for young pigs, and the quality of the meat is high.

Butter-milk.—Provided no water is added, this is of equal value to skim milk. It must be borne in mind that butter-milk from factories almost always contains a considerable amount of added water, sometimes as much as 50 per cent., and consequently by itself is not a sufficient food for pigs. Many instances can be given of considerable mortality among pigs fed solely on butter-milk, practically from starvation, because they were not able to consume enough butter-milk plus water to derive sufficient nutriment to satisfy the demands of nature. But when the deficiency in solids is made up by adding meal, or even grass, roots, or other fodder, pigs are found to thrive on butter-milk.

We have to remember that a pig requires about 2 lbs. of feed equal to pollard per day per 100 lbs. live weight for the purpose of keeping up the system; that is, to keep up the temperature, repair, waste of tissue, &c., and that butter-milk contains 90 per cent. water and 10 per cent. solids. From the results of trials with some hundreds of pigs, it is found that pigs of 50 to 100 lbs. live weight consume on

an average 3.35 lbs. of feed equal to pollard per day. Pigs of 100-150 lbs. live weight will eat 4.79 lbs., and those of 150-200 lbs. consume 5.9 lbs. per day. It will be seen from this that it would be necessary that they should consume in the last case 59 lbs., or practically 6 gallons of butter-milk, for the same result; and should the butter-milk be diluted by half, as is often the case, it would require half as much again, or 9 gallons, to produce this result.

Whey.—This has not nearly the feeding value that separator milk or butter-milk has, especially for young animals, nor will it produce as good quality bacon, unless food rich in protein be used in conjunction with it. This is due to the fact that only a small percentage of protein remains in the whey, the bulk of it being removed in the form of curd. A high percentage of sugar, however, remains, and when mixed with food rich in protein, such as peas, beans, &c., is a valuable food, particularly as it is easily digested and there is no waste. Whey has been found to have a higher feeding value than turnips 1 lb. for 1 lb. when fed with meal. The Danes find 12 lbs. of whey equal to 1 lb. of barley-meal, so that 2 lbs. of whey are equal to 1 lb. skim milk. This value can only be obtained by feeding it with a good proportion of meal, say 3 lbs. whey to 1 lb. of meal.

Root Crops for Feeding.

All the root crops provide valuable pig food when fed in conjunction with grain, and, unlike grain feeds, the roots are better cooked after having the earth removed by washing. If this is not done, the effect will probably be that it will scour the pigs too much. In the case of potatoes, the water must be thrown away, not mixed with the food, as there is a substance in the skin that has a prejudicial effect on the health of the pig if allowed to consume it. Artichokes, potatoes, mangels, beet, carrots, turnips, parsnips, pumpkins, cabbage —all are good. With regard to cabbage, Sanders Spencer says they are liable to cause constipation, which if not removed will frequently be followed by fever more or less dangerous. Some hold that turnips fed to pregnant sows are liable to produce abortion. Mangels and turnips are not conducive to prime quality pork.

Potatoes have been proved to be valuable as a food for production of pork when fed in combination with grain, and more especially with the addition of skim milk or whey. The most satisfactory of all being 1 lb. grain to 3 lbs. skim milk and 3 lbs. potatoes. Four lbs. of potatoes are equal to 1 lb. of grain.

Sugar-beets.—Pigs seem to prefer sugar-beet to almost any other kind of roots. Only limited quantities of roots should be fed to fattening or very young pigs.

Artichokes (Jerusalem).—Of this plant, Mr. Potts, Principal of Hawkesbury College, writes:—"This is a flowering perennial plant which has in the past been overlooked as a valuable food for pigs. It grows from 6 to 9 feet high, and, when in bloom, seen from a distance the crop looks like one of miniature sunflowers. The stalks are frequently used for feeding sheep, or conversion into silage, and the tubers afford a palatable and succulent food for pigs. The plant is very persistent in growth, and if raised in suitable soil is difficult

to eradicate. Enough tubers, as a rule, are left each year to continue the crop, hence it is wise to set apart a permanent paddock for it, or the odd corners of a farm or waste places of little value for other crops may be used for growing artichokes.

The plant is extremely hardy; it resists frost and drought. Whilst the best crops are raised on good mellow loams, profitable yields are secured on stiff clay lands, light sandy or gravelly soils.

The land is best suited where the drainage is good; in fact, any soil suitable for potatoes will answer for artichokes. It is a crop that requires little attention when it is established. The soil needs thorough cultivation. It should be deeply ploughed about May or June. During the winter it may be harrowed occasionally, lightly re-ploughed about September, and well manured. The tubers are then planted by dropping them into furrows 3 feet apart with a space 2 feet between the tubers. If the sets are small, plant whole, while large ones may be cut. Cover by turning a furrow over them. About 4 cwt. of tubers will plant an acre. The crop matures in five months. Should rain fall immediately after planting, the harrow may be run over the land to fine the surface. This should be repeated when the plants are 4 inches high. It checks evaporation, destroys weeds, and will not injure the crop. Later on the cultivator should be kept moving between the rows about once a month.

When the crop flowers and the tops droop and die, about April or May, it is ready for harvesting. The average yield will be from 7 to 8 tons per acre.

Two varieties have been tested here, and gave the following results:—

Jerusalem, White, 9 tons 1 cwt. per acre.
Jerusalem, Pink, 6 tons 16 cwt. per acre.

For feeding pigs, it is best to turn them into the crop to root out the tubers. It must be remembered that, where it is desired to continue the crop, the pigs should be removed before all the tubers are eaten.

Few foods are more relished by pigs. The tuber in the raw state is very nutritious, more especially for pregnant sows, and also sows reduced in weight and condition after suckling and weaning big litters. This class of food acts as a diuretic, or promotes a healthy action of the kidneys in secreting urine; it relieves constipation and stimulates liver functions. One acre will support twenty sows from four to six months.

Young growing pigs evidence considerable growth on being fed with them for a short period. The exercise obtained in harvesting or rooting up the tubers has a beneficial influence. It is especially notable that artichokes are very digestible. The outcome of a number of tests go to show that for fattening purposes these tubers must be given with grain, and have a similar result to feeding with ordinary potatoes. 325 lbs. wheat fed with 820 lbs. artichokes gave 100 lbs. increase."

This crop was extensively grown for pigs by Mr. Syme, at Dalry, near Healesville.

The average composition of artichoke is shown here in contrast with the potato:—

—	Water.	Ash.	Protein.	Carbo-hydrates.	Fat.	Nutritive Ratio.
Artichoke	79·5	1·0	2·5	16·7	·2	1·7
Potato ..	78·9	1·0	2·1	17·9	·1	1·86

It is found that about 30 lbs. of artichokes will produce 1 lb. pork, which at 4d. amounts to approximately £10 per acre.

Tares, Clovers, and *Lucerne* are all valuable feeds when fed in conjunction with more concentrated grain or mill offal.

Rape is a very valuable food, and can be either pastured or cut and fed to them in the pen.

Molasses may be added to the food in small quantities, but must not be looked upon as a food, but more as an appetiser. It will also act as a laxative.

Fruit.—The waste of the orchard may be turned to profitable account by combining with grain, and for this purpose may replace roots.

Salt.—A little salt is necessary for pigs for promotion of digestion, but it is best supplied in the form of a condiment, as advised in a previous article.* Recent experiments have proved the value of this mixture when added to the food daily.

Bone-meal.—Growing pigs require to draw extensively on the protein of the food for bone-forming material to such an extent that other ingredients in the food are often to a large extent wasted. When one tablespoonful of bone-meal per pig has been added daily to the feed, it has been found to save 25 per cent. of the food required when no bone-meal was fed.

A summary of the results of the different methods of feeding, when presented in concrete form, are sufficiently striking:—

Assuming that it costs 3d. per lb. for production—

Cooking the food increases amount required 6 per cent., increasing cost .18 of a penny.

Crushing against feeding whole reduces amount required 7 per cent., reducing cost .21 of a penny.

Soaking thoroughly reduces amount required 7 per cent., reducing cost .21 of a penny.

Grinding and soaking as against cooking reduces amount required 13 per cent., reducing cost .39 of a penny.

Shelter as against exposure reduces amount required 25 per cent., reducing cost .75 of a penny.

Mixing two or more grain feeds reduces amount required 20 per cent., reducing cost .6 of a penny.

Clover or lucerne hay soaked reduces amount required 30 per cent., reducing cost .9 of a penny.

A mature pig requires more than young—reduces amount required 33 per cent., reducing cost one penny.

* *Journal of Agriculture,* Vict., April, 1912, p. 255.

It is not inferred that the whole of these savings can be effected, but it indicates the lines on which feeding should be conducted, and the reasons therefor.

It must be borne in mind that the pig, like the horse, has comparatively small intestinal capacity, and consequently requires its food in a concentrated form, unlike the cow or sheep, which require bulky food.

When increase in weight is spoken of, live weight is generally meant; the difference between that and carcass may be taken as 25 per cent., or one-fourth.

PIG MANURE.

Few farmers appear to realize the value of pigs' manure, or we would not see so much going to waste as is the case on the majority of the farms in this State. Most farmers have proved that increased returns are obtainable by manuring crops with some purchased artificial manure, but do not trouble to conserve the more valuable material they have in the piggeries, for besides this containing all the chemical elements required by growing crops, it is teeming with myriads of micro-organisms which are necessary to enable the plants to make use of plant food supplied. It should be understood by pig feeders that every ton of food bought and fed represents so much manure made available in a more valuable form than it was originally. The following table gives the approximate value of the manure from every ton of food given to pigs, and should show the necessity of making provision for properly conserving the manure, and that purchasing food for pigs is an indirect way of manuring the land:—

VALUE OF MANURE FROM 1 TON OF FOOD FED TO PIGS.

	£	s.	d.
Beans	2	13	0
Peas	2	5	6
Pollard	2	2	3
Bran	2	1	5
Oat branning	2	0	0
Oats	1	5	0
Wheat	1	4	2
Barley	1	2	0
Maize	1	1	0
Malt coombs	3	10	9
Clover hay	1	16	10
Lucerne hay	1	15	7
Dried blood	8	0	3
Skim milk	0	7	8
Whey	0	3	0

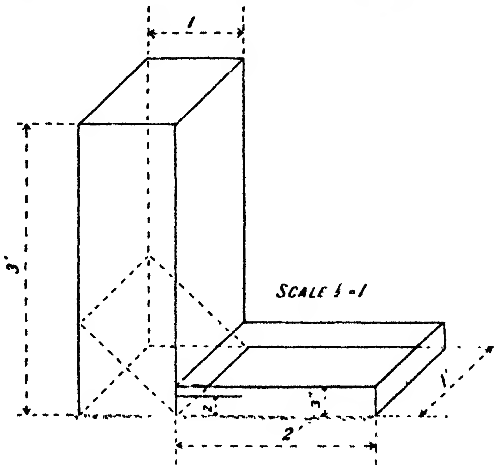
Boussingalt's experiments give the following results:—

	£	s.	d.
Value of manure in producing 100 lbs. of pork from skim milk	1	0	10
Value of manure in producing 100 lbs. of pork from maize	0	7	5
Value of manure in producing 100 lbs. of pork from peas	0	14	10
Value of manure in producing 100 lbs. of pork from clover	1	0	1
Average	0	15	9½

Or, in other words, where pigs are fed on clover and skim milk through summer, and topped off with half peas and half maize, each 1 lb. of pork leaves manure to the value of 1.875d.

THE FEED HOPPER.

This system of feeding has given good results, and has the great advantage in saving of labour. The ilustration given below sufficiently explains the system. This hopper is made of inch boards, and consists of an upright box 1 foot square by 3 feet high, with a horizontal box 1 foot by 2 feet by 5 inches at the bottom. The upright box holds the supply of feed, and the horizontal box is made so as to catch the feed as the pig roots it down. The bottom of the upright box is a smooth slanting board, which guides all the feed to the outlet. The outlet extends entirely across one side of the upright box, and is about 1½ inch wide, varying slightly with the kind of feed used. The different kinds of feed are supplied in separate hoppers, so that the pigs can select which they require. Where there is a scarcity of labour this will be a good system, otherwise it will not give so good results as when the pigs are fed as before recommended.



FEED HOPPER.

TO ESTIMATE THE WEIGHT OF A PIG BY MEASURE.

It requires considerable experience to judge the weight of a pig, and it almost necessitates being connected with slaughtering. Where a large number of pigs are fattened, platform scales should be fixed in the race, so that they can be run on and weighed with very little trouble.

Their weight may be estimated very closely by measuring in the following manner:—

Take the girth just behind the shoulder in feet and inches. The length from that point on top, along the curve of the back to the root of the tail. The head and neck weighs about one-sixth the weight of the four quarters, and is estimated at about one-eighth the value. The girth and length as above, calculated by the rule to find the solid content of a cylinder, each cubic foot equals three stones of 14 lbs. (42 lbs.), and one-third of a foot, or 576 inches, equals 1 stone. So if the contents in cubic inches is divided by 576 it equals imperial stones, and 8 stones 1 cwt.

Rule 1. Square the girth and multiply by the length, both in inches, and the product, multiplied by the decimal .07958, will give the content in cubic inches, which divide by 576 and the result is the weight of the animal in imperial stones of 14 lbs.; or divide by 41 and the answer is in lbs.

Rule 2. Multiply the square of the girth by the length, both in inches, and divide the product by 7238, and the quotient is the weight in imperial stones.

TOMATO CULTURE IN VICTORIA.

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

The cultivation of the tomato in Victoria is steadily growing into an important industry. During the last thirty years great progress has been made in its production, and to-day the culture of this excellent fruit is almost general. Tomatoes, to-day are extensively used either whole or in the making of salads and sandwiches for dessert. In the past the tomato was almost exclusively used for sauce. The uses of this delectable conserve are very varied, and are rapidly increasing as an adjunct to the culinary art. Tomatoes are also used largely for chutney, and in their green state for pickles.

MARKET PROSPECTS.

The prospects of the market are excellent. Locally the demand is a growing one, both from the stand-point of the fresh and preserved

Plate. 1.—General View of Tomato Plantation, Chinese System, Echuca.

fruit trade. For the Inter-State markets, Victoria is producing sauce, pulp, canned tomatoes, and pickles, with a great certainty of large expansion in trade, and the oversea markets, Canada, Africa, Ceylon, and parts of Asia, are opening up for sauce and canned fruit.

There are no statistical data available as to the actual annual production of tomtoes in Victoria, but probably the annual production is about 600,000 bushels from all sources. The area producing this in kitchen gardens and on commercial plantations is not less than 1,000 acres. Tomatoes produce as much as 1,500 bushels to the acre, but the average yield can be placed at between 500 to 600 bushels. In the warm northern areas the objective is the production of early market fruit; this entails much labour and care

in protection against frosts. Early fruits command as high as £1 per bushel case in November and December, and when prices fall to below 3s. a case, about February, production ceases along the Murray and north of Bendigo, as factory prices are unremunerative when freight has to be paid over long distances. At Bendigo the season is a longer one, as when market prices fall the factories are locally available, and this also applies around Melbourne and other factory centres. Factory prices for the last three years are as follow:—

1911	0	9	per bushel case
1912	2	6	,, ,, ,,
1913	1	3	,, ,, ,,
Total	4	6	,, ,, ,,
Average for three years	1	6	,, ,, ,,

Plate 2.—Large Red Tomato, Staked and Trellised, Bendigo

Both in market and factory, fluctuations in prices, according to season and demand, are sure to occur, and there is no attempt to regulate factory prices at present. The cultivation of tomatoes on a commercial scale is a business that requires constant care and attention from the time the seeds are planted until the crop is gathered. It is a highly profitable crop, but requires intelligence to insure success.

VARIETIES.

Tomato—*Lycopersicum esculentum* (Tournefoot). Natural order, *Solanacaea.* A native of tropical South America. General characteristics—Annual; height, 2 feet to 6 feet; leaves, unequally pinnate; leaflets, cut; flowers, yellow, numerous; fruit varies in size and shape, red or yellow in colour in different varieties. The cultivated list of

varieties is very numerous, and many new and excellent varieties are annually added. The following are the requisites for a market tomato:—Early ripening, smooth skin, solid flesh, size large to medium, productiveness and freedom from surface cracks in wet weather; colour should be bright red. In planting for market it is desirable to plant three or four of the best varieties rather than to depend on one. Different seasons may affect different varieties, and a variety giving satisfactory results one year may not do as well as another variety the succeeding year. Another important factor is that with several varieties the daily average picking is more equal, earlier and later varieties distributing the rush in picking over a greater number of days.

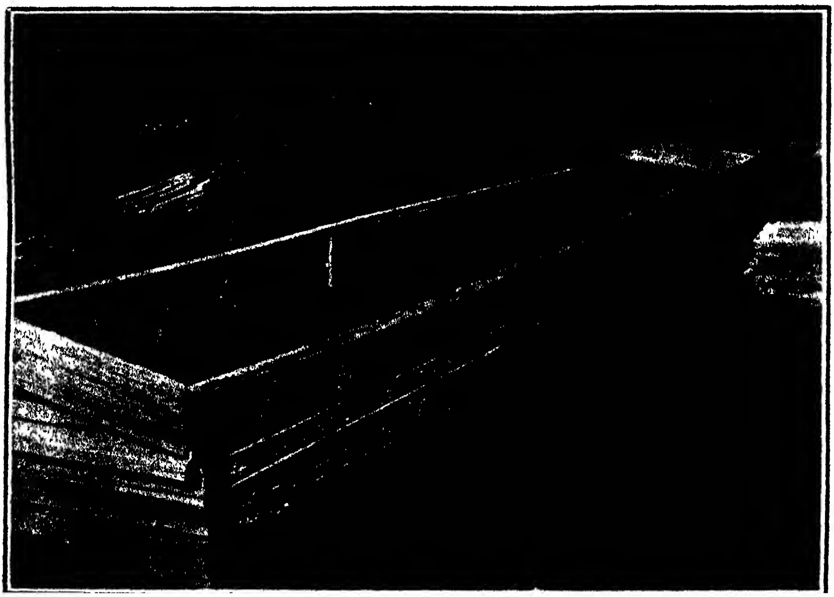


Plate 3.—Hot-bed, Bendigo, showing Glass and Calico Covering.

Varieties recommended and chiefly grown:—

Large Red.—Probably a cross from Ponderosa and Earliana, heavy bearer and early; fruit, very large; flesh, solid, fine flavour; skin, almost smooth; colour, bright red. The most generally cultivated variety.

Earliana.—Heavy bearer and very early; fruit, medium to large; flesh, solid, fine flavour; skin, very smooth; colour, bright red.

Vila Seca (Spanish).—Good early variety; fruit ripens all together; fruit, large; flesh, solid, good flavour; skin, smooth; colour, bright red.

Chalk's Early Jewel.—Early, and good bearer; fruit, large; flesh, solid, good flavour; skin, smooth; colour, bright red, almost scarlet.

Wilding's Early Prolific.—Very heavy bearer, and early; fruit, medium; flesh, solid, good flavour; skin, fairly smooth; colour, bright red.

Key's Early Prolific.—Best dessert variety; dwarf, and bushy in habit of growth; heavy bearer; fruit, medium; flesh, solid, delicious flavour; skin, smooth; colour, bright red.

Other red varieties of excellence—

Stone, Atlantic Prize, Johnson's "Jack Rose," Queen, Burpees' Earliest Pink.

Yellow varieties of excellence used as dessert or for garnishing in salads —

Golden Queen, Lemon Blush, Golden Sunrise, Yellow Plum, Yellow Cherry, Large Yellow.

RAISING PLANTS.

A hot bed is necessary for the raising of the young plants. The usual type of hot bed is shown in Plate 3. The hot bed may also be

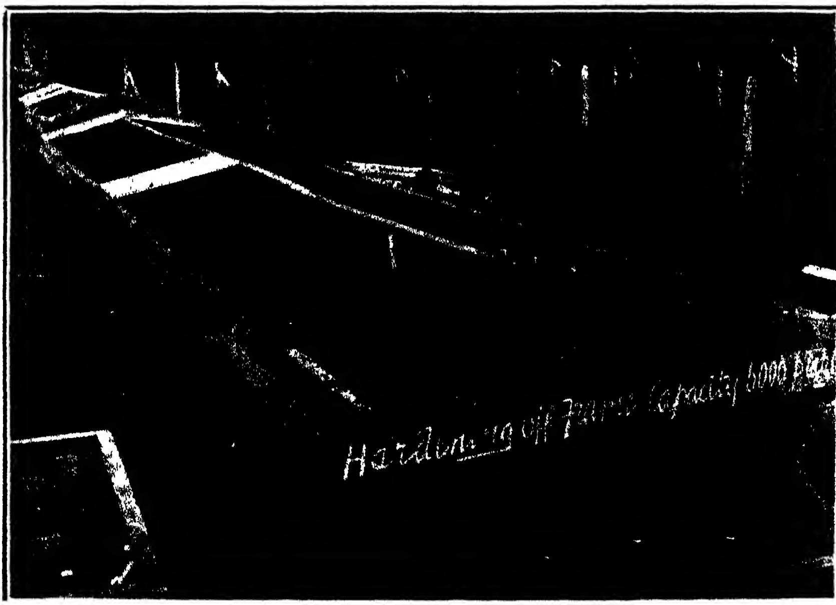


Plate 4.—Cold Frame, Bendigo, showing Glass, Calico Covering, and Tomato Plants in Tins.

constructed by digging out the earth to a depth of 1 foot and building a frame over it. The manure to be placed in the bottom of the frame should be perfectly fresh stable manure, and during the course of a few days should be turned once or twice before placing in the frame. When placed in the frame it should be tightly packed, about 15 inches in depth is necessary. On this is placed a 4-inch layer of well-rotted stable manure or, preferably, good loamy soil free from weeds, and on this the seeds are sown broadcast. The seeds are lightly covered over with fine soil to a depth of not more than ½ inch. Should the soil or rotted manure on which the seeds are sown be very dry, it is advisable to lightly sprinkle the surface with water before sowing the seeds; this is, however, rarely necessary. When the seeds are sown and covered with soil, the glass is placed on the frame, and not removed until the seeds have germinated. The plants should be allowed to

grow for about two or three weeks, and during that time the glass can be gradually removed on sunny days. This will prevent the young plants from growing too spindly. The proper type of plant to aim for, both in the hot bed and the cold frame, is a stocky plant with a bluish-green tint on the stem. This is only achieved by hardening according to weather conditions; an even temperature of 70 to 75 degrees will be found a good guide to work by in the hot frame. When the plants are sufficiently large, say fourteen to twenty-one days old, they should be pricked out singly, with a little earth attached to the root of each plant, and then, with more earth, placed in a circle of zinc or tin of about 3 inches diameter, as shown, Plate 4 by +. If tins or zinc are not procurable, paper funnels can be made, and this system is largely in use with the Chinese, and serves the purpose equally well. The young plants are then placed side by side in the cold, or hardening-off frame, as shown in Plate 4, the interstices between each tin or paper bag being filled with soil. A cold frame has no bottom heat, the regulating of temperature necessary during the hardening-off period being with glass. Calico or hessian covers are also used on the hot and cold frames, as shown in Plates 3, 4. These are made the full length of the frame, and can be drawn over the whole length of glass if necessary, or the glass may be removed and the calico or hessian covering used instead on the cold frame. Plants may also be transferred from the hot to the cold frame without tins or paper, and be put out in lines 4 inches apart each way in 6 inches of good soil, and, when removing to the open, the soil is cut between each row to 6 inches deep and divided at every 4 inches so as not to disturb the earth from the root of the young plant. The plants remain in the cold frame until required to be planted in the open. The young plants will require watering. In the hot frame great care is necesary to guard against overwatering, as it may induce damping off. Should watering be necessary, it should be given only on warm days, or very sparingly during cold and cloudy weather. In the cold frame the young plants should be watered lightly after transference from the hot bed, and should be shaded for two or three days by rolling the calico or hessian coverings over the glass. When the transferred plants have struck root the coverings should be kept off the glass in the day time, and the plants ventilated and watered according to the judgment of the grower. Watering and ventilation are two very important factors, and require much attention.

Seed is sown in June in the Northern and Murray districts, and the young plants removed to the open in August. In Bendigo, late June and July are the months in which seeds are sown, and the plants removed to the open in September and October. In the Midlands and the South, the time of sowing is July and August, and planting in September, October, and November.

(To be continued.)

Chlorophyll or leaf-green is a compound of nitrogen. When a crop does not get enough nitrogen from the soil, its colour is bad, and nitrogenous manures on worn-out or poor soils improve the yield. But the lack of colour may also be due to water troubles—either too much water or too little.

SUCCESSFUL POULTRY-KEEPING.

Valuable Adjunct to the Farm.

By A. Hart, Poultry Expert.

Hints to Beginners.

The value of the poultry industry in our State has increased to a great extent during the last five years, but it may still be regarded as being capable of much improvement. The possibilities of poultry-keeping offer great advantages to those who embark in the industry on correct lines. No other business will produce a return quicker; no other stock will return as much per acre, and nothing else on the farm will multiply so quick as fowls. Combined with this is also the fact

Fig. 1.—Poultry Shed System, 15 birds or more in a pen 10 ft. x 10 ft.

that no country in the world is more suitable for the development of the poultry industry than our Commonwealth. We have only to look at the marvellous figures attained by strains of Leghorns that have been built up here by judicious mating and breeding, combined with the valuable climatic conditions of Australia. Egg producing records that beat the world have been made by these birds on several occasions. Another point is that even when Australian Leghorns are kept in cold climates, and under conditions distinctly unfavorable to egg production, they still retain their excellent laying qualities. An example of this is given by the fact that three Leghorn hens sent from Australia to a poultry-keeper in England were tested for twelve months, and they produced 299, 252, and 234 eggs respectively. This average has been exceeded here by birds bred in our State, but under the severe

climatic conditions of England, coupled with the effect of a sudden change of climate, the figures must be taken as good, being far ahead of any previous English records. These facts must convince even the most sceptical that the poultry industry has a brilliant future before it. The 200-egg hen per year was—a few years ago—regarded as a wonder. But when, under the strictest Government supervision, a pen of six Victorian Leghorn pullets put up an average of 264 eggs each for twelve months, the former figures are small in comparison. That all of our laying stock are not capable of reaching these figures I am quite prepared to admit. If a flock of hens would return an average of 180 eggs each per year, at the ruling price for 1911 and 1912 that would mean a gross return of 17s. 6d. per bird, which, when the expense of feeding and attention is deducted, would leave a profit of 7s. or 8s. from each hen. As 600 or more hens can be kept on an acre, the profit per acre would work out about £200.

One valuable point in poultry-keeping is that it can be made a very suitable adjunct to farming, dairying, or fruit-growing. It will accommodate itself well with all or either of these industries, lessening the cost of production in various ways, allowing the produce to be sent to market in a concentrated form, and also providing a regular source of return to the owner. Grain, fruit, and vegetables can all be utilized to advantage by the poultry-keeper. On the principle that it is not always wise to carry too many eggs in one basket, the combination of poultry-keeping with other industries is to be advised.

Several instances could be quoted where poultry-keeping is made the principle source of revenue, dairying and fruit-growing being the adjuncts. Other cases may be mentioned where poultry farming by itself is returning a satisfactory profit. But experience, as well as suitable surroundings, are essential in these cases, and it would be well for the beginner to start the business in connexion with another industry. Experience is a qualification that leads to successful poultry-keeping, and the only reliable method of securing it is to embark in the industry on moderate lines, gaining experience as you go on and increasing your stock gradually. The bulk of the failures in poultry-keeping can be traced to starting on a large scale without any previous experience. Poultry-keeping appears very simple, and so it is, but people make a mistake when they think all that is necessary to make money out of poultry is to put up a few fowl-houses and runs, stock them with fowls, throw a little food to them twice a day, and collect enough eggs a day to make a handsome profit. The business is not hard to learn, but still it requires several qualifications. An interest in the birds themselves is one of the most important points, and if that is present the poultry-keeper will soon gain sufficient knowledge to manage successfully. But he must not imagine that there is nothing more to learn. In this age of advancement there is bound to be many changes in the feeding, housing, &c., of poultry. Shedding systems in the way of housing and dry food in feeding are two of the latest changes in this respect. It is quite possible that other improvements may be made later on, and the poultry-keeper must advance with the times if he wishes to be successful. Reducing the expenditure in connexion with poultry-keeping is an essential point. But this must be practised in a systematic manner, and, while doing so, it must always

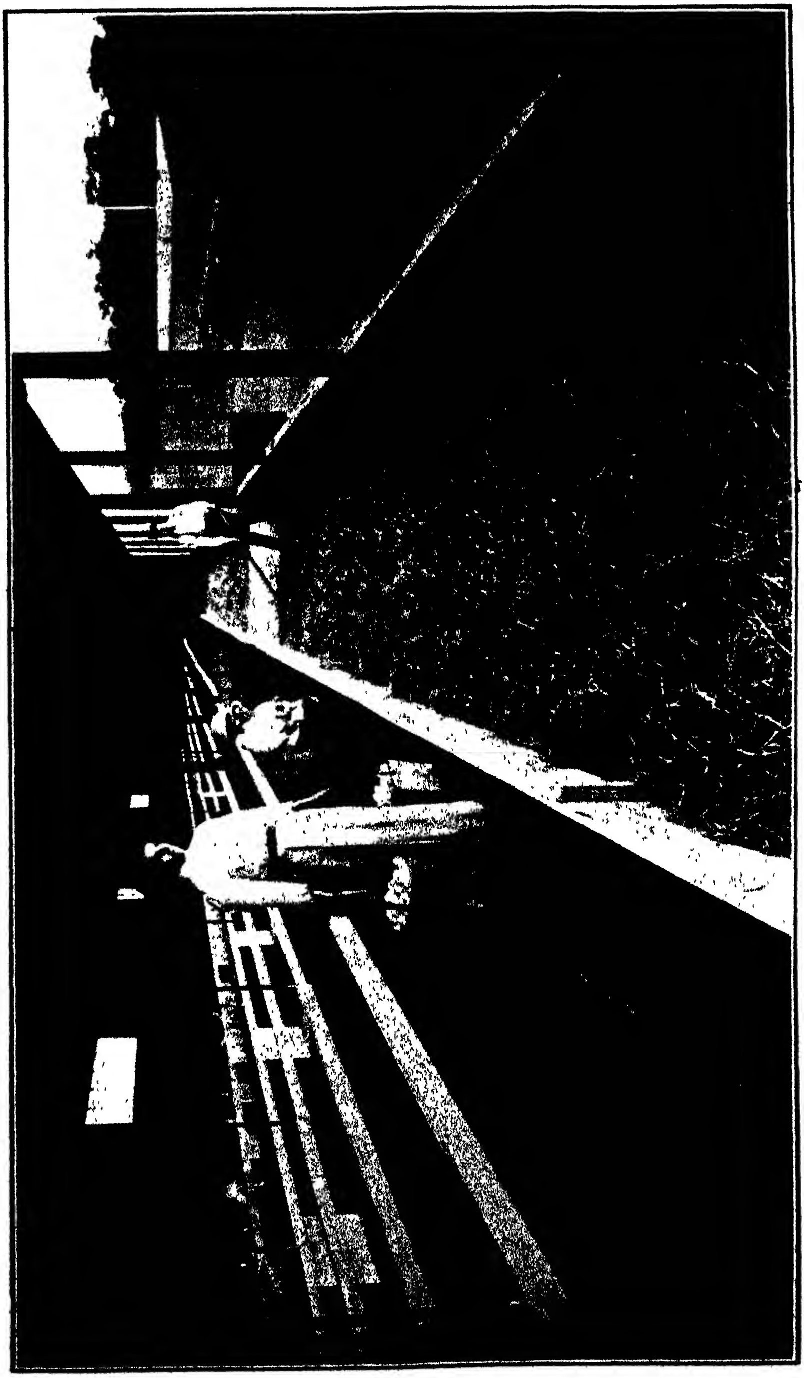


Fig. 2.—Poultry Shed, accommodating 500 birds.

be remembered that the poultry must not suffer in any way through cutting down expense. Up-to-date methods of housing and feeding may save a lot of labour, and in the same way the supply of water may also be provided with practically no loss of time.

How to Start.

When the beginner has selected the breed or breeds he intends to keep it is advisable for him to start with a couple of pens of each variety chosen. In light breeds, six to eight hens can be placed in each breeding pen; and in the heavy breeds about six will be enough. Second season birds are preferable, and always bear in mind that a good laying strain is indispensable. Birds for egg production pay best, and the best breed for that purpose is the White Leghorn. Minorcas, Brown Leghorns, and Andalusians are also good layers. In the heavy breeds, Wyandottes, Orpingtons, and Plymouth Rocks are best, and are also good winter layers, although not up to the standard of the first-named. The beginner should breed about 300 pullets to start with in the first year, increasing this number as he gains experience. Three hundred pullets, if hatched from the 1st of September to the middle of October, should bring in a net return of £100 a year. If egg production is combined with rearing poultry for table purposes, it is advisable to keep Wyandottes, Orpingtons, or Plymouth Rocks.

In mating birds for breeding pens, second season hens are preferable, mated with well grown cockerels of from ten to twelve months old. By this mating you should insure strong and healthy chickens. If pullets are well developed, and over ten months old, they may be used instead of hens, but only when the latter are not available. Beginners should never make the mistake of hatching too many chickens. This generally results in overcrowding the young stock, and death claims a heavy percentage of the birds. In feeding the stock different methods may be adopted. The best morning meal for laying hens is two parts pollard, one part bran, and one part lucerne chaff, or green lucerne, clover, rape, thousand-headed kale, or silver beet, chaffed or cut fine.

When lucerne chaff is used, it should be steamed over-night. Warm water or milk should be used to moisten the mixture. When skimmed or separated milk is used, it should be first mixed with the bran, then add the pollard and green stuff, mixing the whole thoroughly. About 3 ozs. of this mixture is sufficient for each laying hen. The meal should be fed in troughs, so that no waste occurs, and the food is also kept clean. Animal food is good for laying stock. Blood meal, meat meal, livers, or other butcher's offal are very suitable (the latter being well cooked before using), and about 1 lb. may be given three or four times a week to every twenty laying fowls.

Blood meal may be obtained at the City Surveyor's Office, Town Hall, Melbourne. For the evening meal the best grain is wheat, heavy oats, maize, and peas come next as they are written. About 1¾ ozs. is sufficient for each bird. But the weights mentioned need not be accepted as a hard-and-fast rule. It is always advisable to give them as much as they will eat readily, and the quantity given may be safely regulated by the interested attendant. It is advisable to throw the grain among the litter with straw, chaff, or other short material, as it

provides the fowls with good exercise in scratching for the grain. During the hatching season, birds in the breeding pen may be fed in a slightly different manner. Give meat scraps regularly every day in small quantities, and at midday a supply of green food should be

Fig. 3.—Economy in Feeding and Labour Saving in Collecting Eggs.

provided. A change of grain is also useful, as birds sometimes tire of one kind. Wheat can be given four times a week, and oats, maize, and peas may be substituted for the other three days. The male bird should be examined for vermin, and watched closely, and, if he does

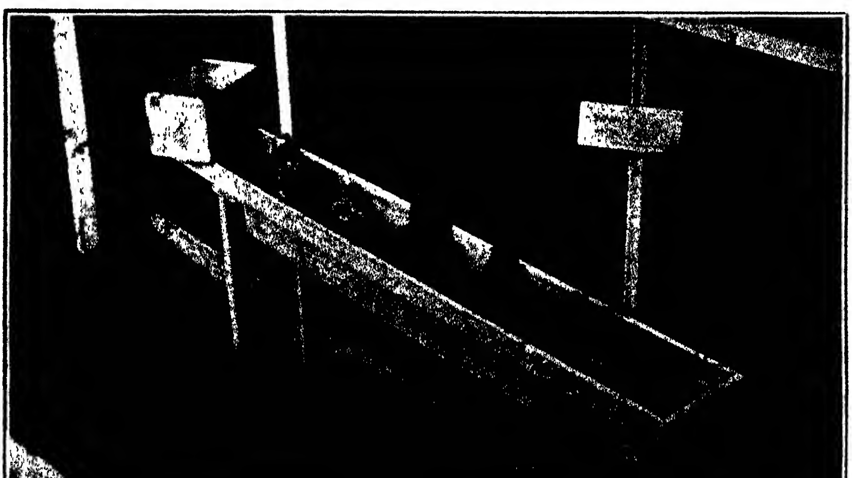


Fig. 4.—Vermin-proof Nest, simple and effective

not feed well with the hens, he should be fed in a pen by himself. Two male birds for each pen may be recommended, one to be used every alternate week. This is the best method of securing a large percentage of fertile eggs. Shell and sharp grit must also be provided, and a

liberal supply of each should be always available. Charcoal is also an excellent thing for poultry. A regular supply of drinking water must be provided. The drinking vessel should be placed from 9 inches to 1 foot above the level of the floor, so that the water will be kept clean. The best method of watering is to have it laid on in pipes, when

Fig. 5.—Successful Egg-farming, Goulburn Valley.

the drip system may be practised, so that the water is always fresh. It should also be shaded from the sun and wind.

Fowl-houses.

A useful style of a double fowl-house is illustrated. It is 7 feet in length, 5 feet wide, 6 feet high at the front, and 6 feet 6 inches at

Fig. 6.—A Complete Plant in connexion with a Poultry Farm, all grain utilized for stock.

the back, with nest boxes placed at the side of the house. Good serviceable material should be used in its construction. Palings and lining boards will form the covering, and hardwood should be used in the frame. By raising the floor of the house 2 feet from the ground it will provide a shelter and dust bath for the birds underneath the

floor. The material used for the dust baths is two parts wood ashes and four parts sand, to which may be added 1 lb. of powdered sulphur. The size of the yard or run varies according to the number of birds

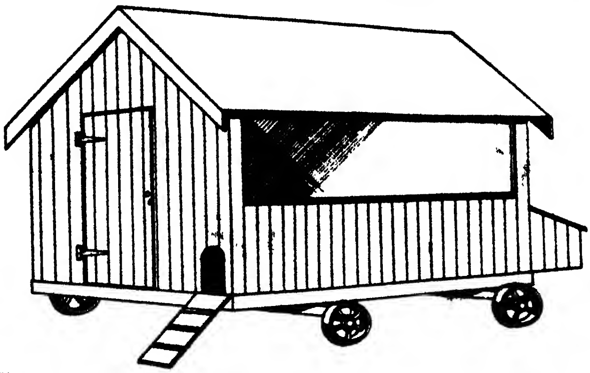


Fig. 7.—Portable Fowl-house for the Stubble Fields.

kept. About 40 feet by 10 feet is enough for fifteen to eighteen birds, and as they always give the best results when kept in small flocks, this size of yard and house is preferable.

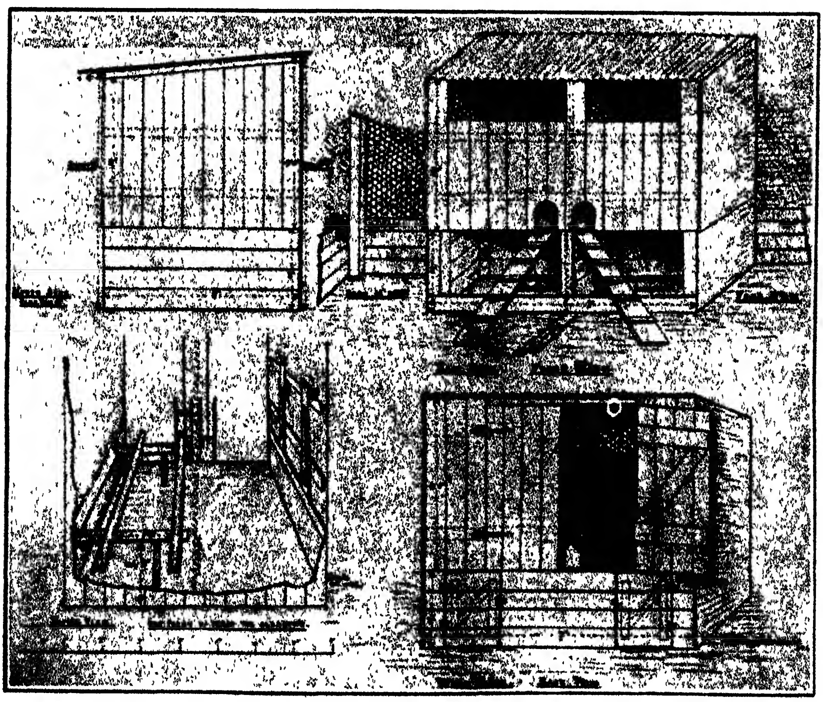


Fig. 8.—Plan of Double Fowl-house.

The shed system of keeping poultry is now becoming popular, and good result have been obtained in egg production where it has been used. Where flocks of 500 are running together, a shed 100 feet long

by 20 feet wide, as illustrated, is suitable. This will give plenty of room for accommodation, and also allow of a scratching space 100 feet long by 10 feet wide. The birds are kept in these sheds, except when the weather is very fine, when they are let out for a few hours. A shed 10 feet by 10 feet will hold fifteen birds all the year round. All fowl-houses and sheds should, where practicable, be built on a slope towards the east. Where the shed system is adopted, the floor should be prepared by ramming down moist clay to a depth of 3 inches above the top of the ground. Then put a coating of boiling tar evenly over the surface. Sand may then be sprinkled, and the floor allowed to dry and set properly. All perches should be movable. They should be at least 2 inches wide, and set on hardwood cross pieces. The perches and cross pieces should be regularly dressed with a solution of carbolic acid, or pure kerosene, so as to keep down the "Red Mite."

Incubation.

Where a large quantity of chickens is hatched, or where early young stock is required, incubators are indispensable. The hatching and rearing of chickens is one of the most important points in poultry rearing. To insure success in this respect, strong and vigorous breeding stock is the first requirement. In regard to the time of hatching, it is advisable that the correct time should be observed. The most favorable time to hatch chickens from White Leghorns for winter eggs is from the 1st of September to the middle of October. If the stock is for breeding purposes, they may be hatched in June, July, and August.

Incubators have now been brought to such a stage of perfection that an amateur, observing the conditions sent out with the machine, can manage it easily.

Eggs selected for incubation should be as fresh as possible, of good shape, even and smooth in shell, and of fair size.

The shells of tinted eggs are generally thicker than the whites, and take a day longer to hatch. To obtain the best results, fill your machine at the start. The incubator should be heated up to 102 degrees before the eggs are placed in the drawer. It should then be kept as near that temperature as possible for the first week of incubation, and for the remainder of the time at 103 degrees. Tested thermometers should be used, and two may be placed in one drawer. Eggs should be allowed to cool down as follows:—On the 4th day, to 90 degrees; and up till the 19th day, to 85 degrees. The bulb of the thermometer should be placed between two eggs in the tray when they are out-cooling.

Treatment of Chickens.

After twenty-four hours, the chickens should be removed to the brooder, and fed on biscuit meal, stale bread crumbs, and flaked oatmeal, moistened with raw eggs or new milk. A little of this may be given every two hours. After five or six days the above mixture

should be discontinued and the following dry mash should be given in hoppers for the first month:—

Bran	25 parts
Flaked oatmeal	25 ,,
Biscuit meal	25 ,,
Millet white	15 ,,
Fine shell grit	5 ,,
Dry bone meal	5 ,,

A good mixture for chickens is as follows:—

Cracked wheat	25 parts
Hulled oats	25 ,,
Peas, cracked	10 ,,
Maize, cracked	5 ,,
Sand, coarse	5 ,,

This mixture should be given to the chickens in the litter, to make them scratch for it. The best litter is chaff—lucerne chaff preferred.

Animal food such as boiled liver, sheep's head, or rabbit, should be put through the mincer and given to the chickens once or twice a week. All green stuff, such as lucerne or milk thistles, should be cut fine and given to the chickens in the middle of the day. After two months chickens may be fed the same as adult birds.

All pullets should be separated from the cockerels when they can be distinguished properly, as it gives both sexes a better chance of improvement. When birds are intended for table purposes, they should be kept in flocks of nearly the same age and size if possible, the same rule applying in other cases of growing stock.

In conclusion, I would again remind my readers of the great possibilities of the poultry industry and the vast increase that could be made in this respect. In the hands of experts, combined with the assistance from the Department of Agriculture, much has already been done, and, with the foundation already laid, a vast trade could be built up. The egg production of our State is not at present enough for our own requirements. There is every prospect of being able to send our surplus eggs to England to compete against the world's supplies, and in the near future there should be a valuable trade opened up in this respect. England imported from foreign countries in 1911 eggs to the value of £7,965,800. The market is there, and what has been already done in meat, butter, and other products of our State should be successfully followed by the export of eggs and poultry to the London markets, where there is practically an unlimited demand for high class products.

PROCESSES IN THE SOIL—

There are two great processes going on continually in the soil which are known to be due to the activities of bacteria:—(*a*) The conversion of ammonia and other compounds containing nitrogen, derived from decaying organic matter and nitrogenous fertilizers, into nitrates, the only form in which, so far as we know, plants can utilize the nitrogen. (*b*) The utilization of free nitrogen of the atmosphere by leguminous plants. Both these processes are greatly facilitated by the presence in the soil of a sufficiency of lime.—*Mark Lane Express.*

GENERAL NOTES.

REASONS FOR DRAINING—

The chief object in draining wet land is not to remove the extra water. A wet soil is, of course, a colder soil, but in Victoria this would seldom be a sufficient reason for draining. The main object in draining land is to admit fresh air, and this can only be accomplished by getting the water out. Plant roots must breath, and nitrification in soils needs fresh air, and in water-logged soils these results can only be attained by first removing the water. In an article contributed to the *Deut. Landw Presse* 39 (1912), the results of several years' observations on the effect of drainage are recorded. It is concluded that the most important factor concerned in the increased productivity of a soil from tile draining is the improvement in aeration. In order to increase the aerating effect, the tiles were sometimes connected with the upper air by placing vertical flues, but the results of this departure from ordinary practice are as yet inconclusive. The experiments are being continued. Probably the air drawn into the soil as the water soaks into drains in the usual way gives sufficient aeration in ordinary cases, and circumstances are conceivable which would even render the upright flues an impediment to aeration. The foul air or carbonic acid gas, produced in soils is itself heavier than air and subject to diffusion, will slowly find its way down the drains when these are not carrying water. This flow of gases will be faster the greater the fall in the pipes, and particularly when the subsoil is much colder than the upper air. But the most important action of drains is to promote aeration by first taking the water out.

FINE WOOL—

Professor Barker, of the Bradford Technical College, in the course of a recent lecture before the Bradford Textile Society, declared that Bradford to-day was in many cases demanding a finer wool simply because it was found that the finer wool could be manufactured into fabrics which commanded a more regular market than fabrics manufactured from coarser wool. He predicted a big shortage of fine wools in the near future. Commenting on these remarks, the *Farmers' Advocate* (N.Z.) states that the demand for fine wools has been a marked feature of the local wool sales for several seasons past, and appeals to pastoralists, especially small holders, to give consideration to this demand of the trade.

IMPROVED SEED GRAIN—

In a report recently issued by the United States Department of Agriculture attention is drawn to a new movement in the seed trade. A number of "experimental associations" and "crop-breeders' associations" have been formed in different States. The objects and methods of the two kinds of association appear to be somewhat similar. Of the first kind, the Wisconsin Experimental Association furnishes an example. It is composed of persons who have attended the State Agricultural College. The experiment station attached to the college supplies members of this association with seed of new varieties of grain

produced at the station, or obtained from other growers, and the members thus become distributors in their respective communities. When inquiries for seed come to the station the inquirers are referred to the member of the association who lives nearest them. "The neighbours of the association members are usually quick to realize the value of new and improved varieties grown by the association men, and are ready to purchase seed from them at good prices." In other States the organization takes the form of crop-breeders' associations. The secretary here is usually a member of the State experiment station, and inquiries coming to the station and college are referred to him. He also publishes lists of members who have seed for sale, giving details of varieties, quantities, and prices asked. With a sale, some guaranty as to quality, purity, and germination is generally supplied. This organization of seed-growers under expert guidance is regarded by the Washington Department as a policy which "it is desirable to encourage as far as possible."

THE VICTORIAN RAILWAYS—

According to the latest *Monthly Summary of Australian Statistics*, Victoria in the past financial year had 3,622 miles of railway open for traffic. The number of train miles run was 13,837,000, which constituted a record for the State. The gross earnings for the year totalled £5,218,967, and the working expenses for the same time £3,441,803. This left a credit balance of £1,777,164, representing the net earnings of the railways. The net earnings work out at 2s. 7d. per train mile run, and return 3.88 per cent. on the capital cost of construction and equipment, which is stated at £45,837,000. As compared to the other States, Victoria leads slightly in the matter of net earnings per train mile, but with 3.88 per cent. it falls just slightly below most of them in the return for capital sunk. Thus New South Wales returned 4.34 per cent., Queensland 3.95, South Australia 5.09, Western Australia 4.09, and Tasmania 2.15 per cent. Alike in the rate of interest obtained, and its position in this matter relatively to the other States, the Victorian railways have been very consistent during each of the past five years.

Experiments show that sheep require about 2 lbs. of water for 1 of dry food, horses 2 or 3 to 1, and cattle 4 to 1. Pasture grass in the green state contains 70 to 80 per cent. of water.

*SOME BUTTER MAKING EXPERIMENTS AND ANALYSES.

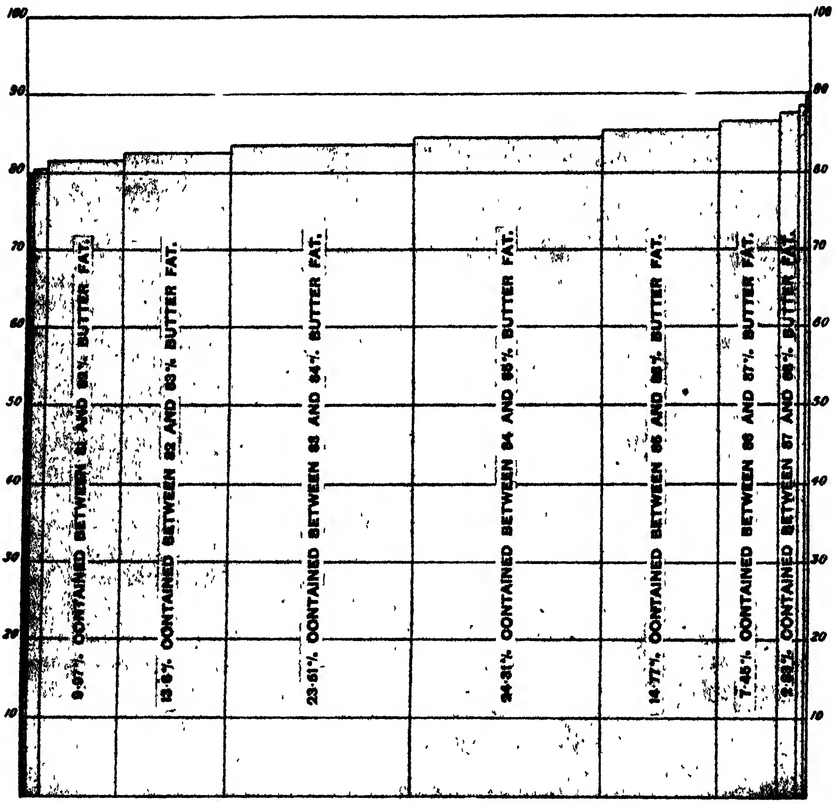
By R. Crowe, Exports Superintendent.

IS SALT A BUTTER PRESERVATIVE.

From time to time doubts have arisen and have been expressed as to whether salt in butter had any preserving effect, or if it was only a flavouring agent. An experiment which was concluded early in

* Paper read at the Melbourne Meeting (1913) of the Australasian Association for the Advancement of Science.

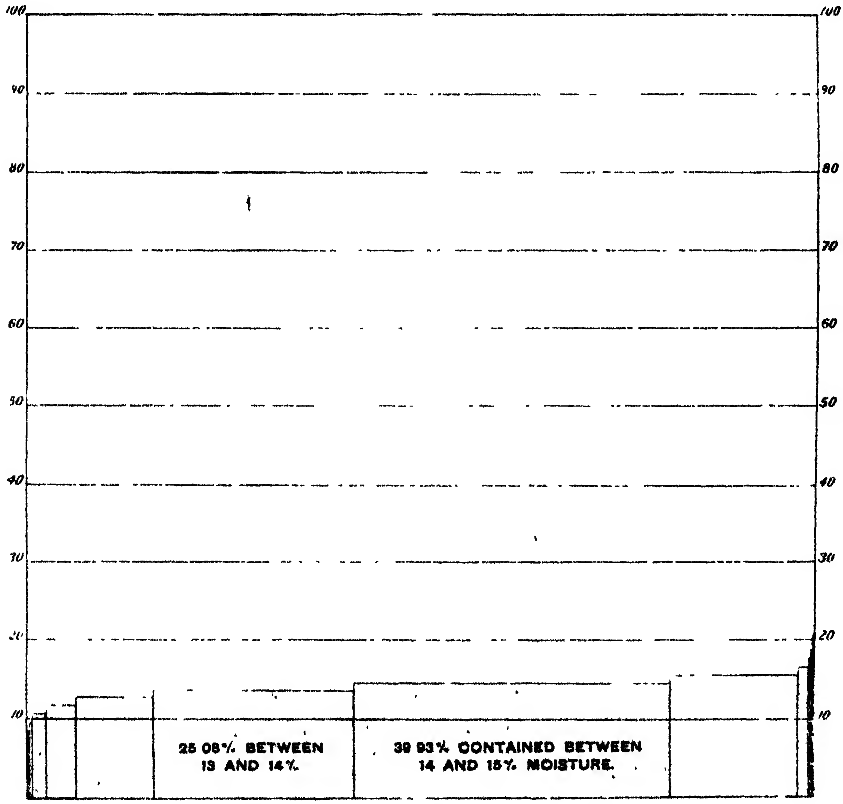
November last with one parcel of butter from the same churning showed that the sample which had no salt or preservative in it was better after keeping for some months than the duplicate sample with only salt added. On noting this result, three factory managers were written to—one in the Western District, another in Gippsland, and the third in the Goulburn Valley. They provided butters from the one churning, now five weeks old. The Western District sample made without salt or preservative is still a first grade butter, meriting 91.5 points, whilst the duplicate to which salt was added in the process



PERCENTAGES OF BUTTER FAT IN BUTTER.

of manufacture is now distinctly a second grade butter, worth only 86.6 points, so that there is a difference in grade separated by 4.9 points. The Gippsland butter made without salt or preservative merits 91.66 points, whilst the duplicate sample containing salt is worth 89.16 points. There is therefore a difference of 2.5 points between the two in favour of the saltless sample. The Goulburn Valley samples are much the poorest in quality; that without salt scores 85 points, whilst the duplicate with salt is marked down to 83.6 points, showing a difference of 1.4 points. These results show distinctly that butter without salt keeps better over a lengthened period in cool storage than salted butter.

Naturally, quite a number of questions are suggested as the outcome of this result. What is the reason Why is the difference in favour of saltless butter greater in one instance than another? Was all the salt used contaminated each to a different degree? Has the presence of salt favored the development of putrefactive organisms, and was this change hindered through the absence of salt, or does salt assist in the chemical change known to take place in butter by long keeping? Each one of these suggestions will receive further attention during the present year, and of all of them it is more likely that the presence of salt facilitates bacterial development in butter than



PERCENTAGES OF MOISTURE IN BUTTER.

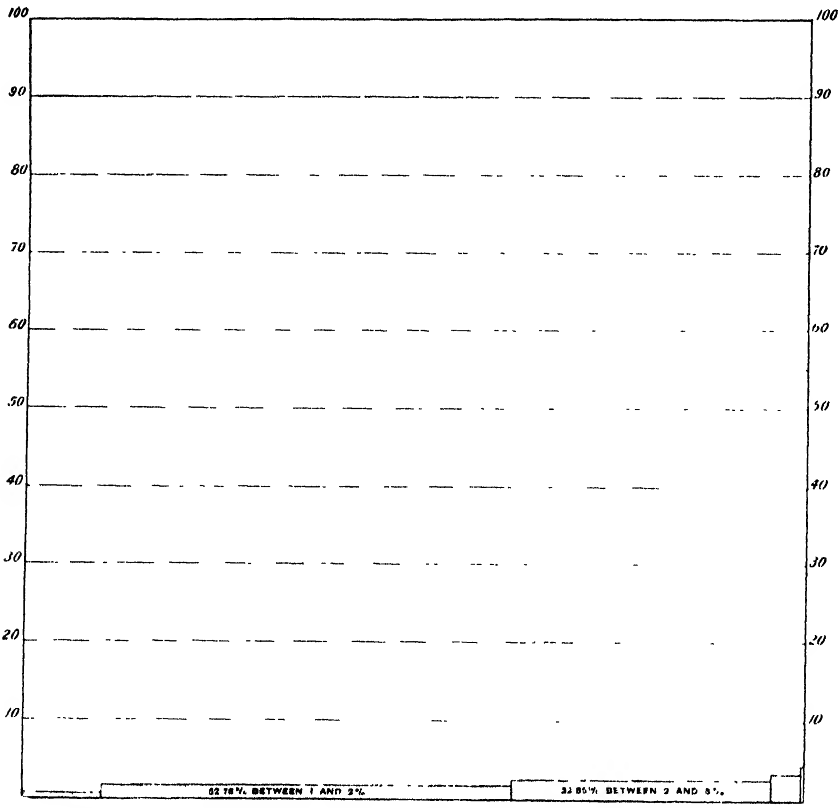
that the salt was contaminated or that it was instrumental in bringing about a chemical alteration.

The percentage of the total butter exported yearly without any salt is 35, and unsalted butter usually commands a higher price by 2s. per cwt. than that which is salted, the reason given being that butter in that form is more suitable for blending purposes or for sale as Normandy, or in competition with Normandy unsalted butter. It has been generally known, however, for many years past that unsalted butter keeps better, and is much less liable to develop the fault known as "fishiness." In connexion with the question of price, it should

be remembered that unsalted butter contains, on the average, slightly more butter fat than salted butter, and also a greater percentage of moisture.

BUTTER ANALYSES.

Butter Fat (including Casein).—During the last six years the analyses for butter fat (including casein) of 1,625 samples of butter have been recorded. (*Vide* Appendix A.) The average result is 84.23 per cent. Three samples, or 0.18 per cent., contained over 89 per cent., whilst one, or 0.06 per cent., was found to contain under 79 per



PERCENTAGES OF SALT IN BUTTER (NOT INCLUDING UNSALTED BUTTERS).

cent. of butter fat (including casein). As the average casein content may be stated at 0.73 per cent., the butter fat contents of the 1,625 samples would therefore average 83.5 per cent.

Moisture.—During the last seven years the analyses for moisture of 13,193 samples of export butter have been recorded, and these average 13.84 per cent. (*Vide* Appendix B.) Four samples, or 0.03 per cent., were found to contain over 20 per cent. moisture; 337 samples, or 2.55 per cent., were found to contain over 16 per cent. moisture; whilst 13 samples, or 0.1 per. cent., showed under 8 per cent.

There has been a great deal of controversy from time to time as to the maximum moisture contents which should be allowed in butter. Whilst the maximum allowed was 16 per cent., the average moisture contents varied from 13.44 per cent. in 1907-08 to 13.97 per cent. in 1909-10. It is worth noting that the average for 1910-11 season was 13.82 per cent., when the maximum allowed was 16 per cent., whilst for 1911-12 the average rose to 13.91 per cent., when the maximum permitted had been reduced to 15 per cent.

Curd.—In the course of the last six years the analyses of 627 samples have been registered, which (*vide* Appendix C) give an average of 0.76 per cent. Some 40 samples, or 6.38 per cent., were found to contain over 1 per cent. of curd, whilst 5, or 0.8 per cent., yielded under 0.3 per cent. It must be mentioned that attention was directed chiefly to butters suspected of containing a high curd content, so that it would be misleading to assume that the average of all butter produced in the State was 0.76 per cent. of curd; the real average would be lower than these figures indicate.

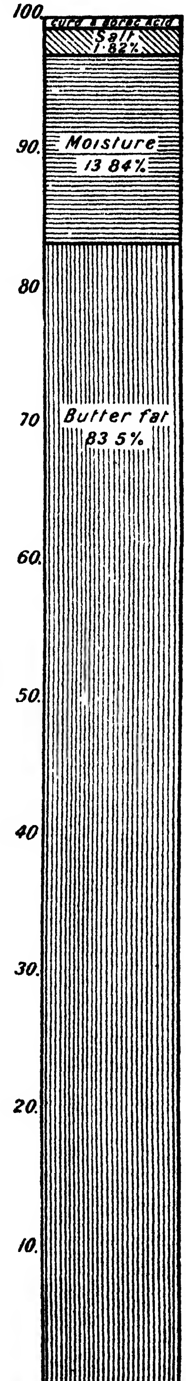
Salt.—The analyses for salt of 1,385 samples of butter have been placed on record during the past six years, with the result that the average comes out at 1.82 per cent. (*Vide* Appendix D.) Four samples, or 0.29 per cent., were found to contain over 4 per cent. of salt, whilst 140, or 10.11 per cent., yielded less than 1 per cent.

Boric Acid.—During the last seven years the analyses of 2,640 samples for boric acid contents have been recorded, and these give an average of 0.2 per cent. (*Vide* Appendix E.) Forty-seven, or 1.59 per cent., were found with over 0.5 per cent., whilst 606 samples, or 20.61 per cent., had less than 0.1 per cent.

SUMMARY.

From these 19,470 results, the average composition of Victorian butter may be stated at 83.5 per cent. butter fat, 13.8 per cent. moisture, 0.7 per cent. curd, 1.8 per cent. salt, and 0.2 per cent. boric acid. It should be noted that the same butters were not analyzed for the different component parts, and hence the only alteration from the previous quoted results, and referred to in appendices, is the dropping of the second decimal place in the case of moisture, curd, and salt.

The great majority of these samples were analyzed by the Federal Analyst, whilst the remainder were analyzed by the State Analyst.



AVERAGE COMPOSITION OF BUTTER.

APPENDIX A.

SUMMARY OF ALL ANALYSES OF BUTTER MADE BY THE FEDERAL AND STATE GOVERNMENT ANALYSTS FOR THE EXPORTS DIVISION OF THE DEPARTMENT OF AGRICULTURE, VICTORIA, FOR THE PAST SEVEN YEARS:—

BUTTER-FAT.

Season.	Under 79 per cent.	Between—										Over 89 per cent	Total Samples.	Mean Average.
		79–80 per cent	80–81 per cent	81–82 per cent.	82–83 per cent	83–84 per cent	84–85 per cent	85–86 per cent	86–87 per cent	87–88 per cent	88–89 per cent			
1906–07	..	..	..	..	..	1	..	1	..	..	..	..	2	83·87
1907–08	.	3	6	19	71	136	110	55	30	5	.	..	435	84·88
1908–09	1	4	11	41	48	84	135	112	51	22	5	2	516	84·65
1909–10	..	1	9	52	79	154	143	72	39	19	10	1	579	83·71
1910–11	..	..	4	44	23	5	4	..	..	..	1	..	81	82·09
1911–12	.	.	..	6	..	2	3	..	1	..	..	..	12	83·13
Totals ..	1	8	30	162	221	382	395	240	121	46	16	3	1,625	..
Per cent to Total	·06	·49	1·85	9·97	13·60	23·51	24·31	14·77	7·45	2·83	·98	·18	..	..

Percentage to Total Samples.

Season.	Under 79 per cent.	79–80 per cent	80–81 per cent	81–82 per cent.	82–83 per cent	83–84 per cent	84–85 per cent	85–86 per cent	86–87 per cent	87–88 per cent	88–89 per cent	Over 89 per cent	Total Samples.
1906–07	..	..	..	..	.	50·00	..	50·00	..	..	..	..	2
1907–08	..	·69	1·38	4·37	16·32	31·27	25·29	12·64	6·89	1·15	..	..	435
1908–09	·19	·78	2·13	7·95	9·30	16·28	26·16	21·71	9·88	4·26	·97	·39	516
1909–10	..	·17	1·55	8·98	13·64	26·60	24·70	12·44	6·74	3·28	1·73	·17	579
1910–11	..	..	4·94	54·33	28·39	6·17	4·94	.	..	..	1·23	..	81
1911–12	..	..	.	50 00	..	16·67	25·00	..	8·33	..	..	..	12
Per cent. to Total Samples ..	·06	·49	1·85	9·97	13·60	23·51	24·31	14·77	7·45	2·83	·98	·18	1,625

Mean average for the 1,625 samples analyzed = 84·23 per cent (including Casein).

APPENDIX B.

MOISTURE

Season.	Under 8 per cent.	Between – 8–9 per cent	9–10 per cent	10–11 per cent	11–12 per cent	12–13 per cent	13–14 per cent	14–15 per cent	15–16 per cent	16–17 per cent	17–18 per cent	18–19 per cent	19–20 per cent	Over 20 per cent	Total Samples.	Mean Average
1905–06	..	..	..	7	36	52	150	127	29	.	..	..	..	..	401	13·72
1906–07	..	.	..	6	11	31	42	78	27	.	.	.	..	..	195	13·92
1907–08	..	..	..	11	23	58	159	107	39	7	1	.	1	..	406	13·44
1908–09	1	1	4	20	40	92	175	90	50	17	13	6	1	2	512	13·69
1909–10	..	1	10	26	72	160	305	326	220	67	21	7	.	..	1,215	13·97
1910–11	12	26	58	117	197	545	1,245	3,079	1,634	124	19	2	4	1	7,063	13·82
1911–12	..	..	8	37	105	358	1,233	1,461	155	33	5	5	..	1	3 401	13·91
Totals	13	28	80	224	484	1,296	3,309	5,268	2,154	248	59	20	6	4	13,193	..
Per cent. to Total	·10	·21	·61	1·69	3·67	9·83	25·08	39·93	16·33	1·88	·45	·15	·04	·03	..	..
Percentage to Total Samples																
1905–06	..	..	.	1·74	8·98	12·97	37·41	31·67	7·23	..	..	..	..	..	401	
1906–07	..	..	..	3·08	5·64	15·89	21·54	40·00	13·85	..	.	..	..	..	195	
1907–08	..	..	..	2·71	5·66	14·29	39·16	26·35	9·61	1·72	·25	..	·25	..	406	
1908–09 .. .	·19	·19	·78	3·92	7·81	17·97	34·19	17·58	9·76	3·32	2·54	1·17	·19	·39	512	
1909–10 .. .	..	·08	·82	2·14	5·93	13·17	25·10	26·83	18·11	5·51	1·73	·58	..	.	1,215	
1910–11	·17	·37	·82	1·66	2·79	7·72	17·63	43·59	23·13	1·75	·27	·03	·05	·01	7,063	
1911– 2	..	..	·23	1·09	3·09	10·52	36·25	42·96	4·56	·97	·15	·15	..	·03	3,401	
Total per cent. to Samples ..	·10	·21	61	1 69	3·67	9 83	25 08	39,93	16 33	1·88	45	,15	·04	03	13·93	

Mean average for the 13,193 samples analyzed = 13·84 per cent.

APPENDIX C.

CURD

Season	Under 3 per cent	Between— 3– 4 per cent	4– 5 per cent	5–·6 per cent	6– 7 per cent.	7– 8 per cent	8– 9 per cent	·9–1 00 per cent	Over 1 per cent	Total Samples.	Mean Average.
1906–07	..	.	..	.	..	1	1	1	..	3	·84
1907–08 . .	1	2	21	39	89	105	83	92	21	453	·78
1908–09 .. .	..	5	16	23	28	11	14	2	10	109	·68
1909–10 ..	3	4	6	9	6	4	4	4	5	45	·66
1910–11 .. .	1	..	1	1	..	3	2	1	2	11	·86
1911–12 . .	.	..	.	2	2	..	..	..	2	6	·88
Totals .. .	5	11	44	74	125	124	104	100	40	627	.
Per cent. to Total ..	·80	1·76	7·00	11·80	19·94	19·78	16·59	15·95	6·38	.	..

Percentage to Total Samples

Season	Under 3 per cent	3– 4 per cent	4– 5 per cent	5–·6 per cent	6– 7 per cent.	7– 8 per cent	8– 9 per cent	·9–1 00 per cent	Over 1 per cent	Total Samples.
1906–07 . ..	..	..	..		..	33·33	33·33	33·33	..	3
1907–08	·22	·44	4·64	8·60	19·65	23·18	18·32	20·31	4·64	453
1908–09 ..	..	4·59	14·68	21·10	25·69	10·09	12·84	1·84	9·17	109
1909–10	6·67	8·89	13·33	20·00	13·33	8·89	8 89	8·89	11·11	45
1910–11	9·09	..	9·09	9·09	.	27·28	18·18	9·09	18·18	11
1911–12 .. .	..	.		33·33	33·33	.	.	..	33·33	6
Per cent. to Total Samples	·80	1·76	7·00	11·80	19·94	19·78	10·59	15·95	6·38	627

Mean average of the 627 samples analyzed = 76 per cent.

APPENDIX D

SALT.

Season.	Under 1 per cent.	Between 1–2 per cent	Between 2–3 per cent	Between 3–4 per cent	Between 4–5 per cent	Total Samples	Mean Average.
1906–07	..	.	2		.	2	2·32
1907–08	34	151	142	6	2	335	1·91
1908–09	36	228	150	15		429	1·84
1909–10	65	320	142	28	1	556	1·74
1910–11	5	27	17	5		54	1·92
1911–12	.	5	2	1	1	9	2·29
Totals	140	731	455	55	4	1,385	..
Per cent. to Total .. .	10·11	52·78	32·85	3·97	·29	.	..

Percentage to Total Samples.

Season.	Under 1 per cent.	1–2 per cent	2–3 per cent	3–4 per cent	4–5 per cent	Total Samples
1906–07	..	..	100·00		.	2
1907–08	10·15	45·08	42·39	1·79	·59	335
1908–09	8·39	53·15	34·97	3·49	.	429
1909–10	11·69	57·55	25·54	5·04	·18	556
1910–11	9·26	50·00	31·48	9·26	..	54
1911–12	.	55·56	22·22	11·11	11·11	9
Per cent. to Total Samples ..	10·11	52·78	32·85	3·97	·29	1,385

Mean average for the 1,385 samples analyzed = 1·82 per cent.

APPENDIX E.

BORIC ACID.

Season.	Under ·10 per cent.	Between— ·10–·20 per cent.	20–·30 per cent.	·30–·40 per cent.	·40–·50 per cent.	Over ·5 per cent.	Total Samples.	Mean Average.
1905–06	13	56	94	85	52	..	300	..
1906–07	49	60	57	23	6	..	195	0·25
1907–08	72	104	124	74	38	3	415	0·23
1908–09	170	121	123	42	11	1	468	0·17
1909–10	201	442	234	132	44	14	1,067	0·18
1910–11	94	171	96	61	16	17	455	0·19
1911–12	7	5	9	3	4	12	40	0·40
Totals	606	959	737	420	171	47	2,940	..
Per cent. to Totals ..	20·61	32·62	25·07	14·29	5·82	1·59	..	..

Percentage to Total Samples.

Season.	Under ·10 per cent.	·10–·20 per cent.	20–·30 per cent.	·30–·40 per cent.	·40–·50 per cent.	Over ·5 per cent.	Total Samples.
1905–06	4·33	18·67	31·34	28·33	17·33	..	300
1906–07	25·13	30·77	29·23	11·79	3·08	..	195
1907–08	17·35	25·06	29·88	17·83	9·16	·72	415
1908–09	36·33	25·86	26·28	8·97	2·35	·21	468
1909–10	18·84	41·43	21·93	12·37	4·12	1·31	1,067
1910–11	20·66	37·58	21·10	13·40	3·52	3·74	455
1911–12	17·50	12·50	22·50	7·50	10·00	30·00	40
Per cent. to Total Samples ..	20·61	32·62	25·07	14·29	5·82	1·59	2,940

Mean average of 2,640 samples analyzed = ·20 per cent.

BEE-KEEPING IN VICTORIA.

(*Continued from page* 305.)

By F. R. Beuhne, Bee Expert.

XIV.—DISEASES OF BEES.

The diseases affecting bees may be grouped under two headings, viz., diseases of the adult bee and diseases of the larvæ, or brood. The latter diseases are the more generally distributed and serious, and the principal ones are known under the general term of foul-brood of bees.

FOUL-BROOD.

This is a contagious disease which kills the young larval bee in the cell. By contact with the remains of the dead grub the disease is transmitted by the adult bees to other cells, thus causing the death of the larvæ from eggs deposited in such cells or the contamination of any honey stored in them.

As the average life of the worker bee during summer is only six weeks, it follows that the number of young bees hatching decreases as the disease advances, the colony soon dwindles in numbers until it finally dies right out or becomes so weakened as to be unable to defend itself against robber bees from other hives. The honey is carried away by bees from other colonies, which in turn become infected, thus propagating the disease indefinitely.

The methods of box-hive bee-keepers, however, have done more to spread disease than anything else. The usual way is to drum the bees out of the upturned hive into an empty box, to cut out the combs, and, after crushing them and straining the honey off, to throw out the residue, and any combs too black for straining, for the bees to clean up. If any of the hives were diseased, the germs are at once re-introduced into the newly-built combs of the robbed hives, while the contaminated honey, when marketed, carries infection to distant localities by means of bees getting access to retail packages after they have been emptied and thrown away.

The cause of foul-brood is a micro-organism growing in the tissue of the larvæ of the bee and sometimes also in the adult insect. It was named *Bacillus alvei* by Cheshire and W. Cheyne in 1885. Since then American investigators have discovered that there are two types of foul-brood, European Foul-brood caused by *Bacillus alvei* and American Foul-brood caused by a micro-organism differing from the former and named *Bacillus larvæ* by Dr. G. F. White, of United States Department of Agriculture, in 1907. The general appearance of the diseased brood is, however, the same in both, and the same treatment is necessary to effect a cure. Whether foul-brood in Australia is caused by *B. alvei* or *B. larvæ* has up to the present not been scientifically tested; probably both are present.

To describe diseased brood to any one not well acquainted with the subject it is best to contrast its appearance to the eye with that of brood in a healthy state. Normal healthy brood shows in compact masses in the comb, that is to say, considerable numbers of adjoining

cells contain larvæ of the same age (Fig. 1). In a diseased comb the brood appears irregular and scattered. Healthy larvæ are of pearly whiteness, plump, and lie curled up on the cell bottom almost in the shape of the letter C. Diseased larvæ are pale yellow, and, further on, turn brown; the grubs appear flabby, and are not so much curled up as healthy larvæ of the same size.

When the larvæ do not die till after the cells have been capped over, cells will be found here and there darker in colour than healthy ones alongside; the cappings usually will be indented instead of convex, and will frequently show irregular holes. (Fig. 2). If these cells are opened, a brown mass is visible which, when touched with a match or straw, draws out stringy or ropy. The ropiness is the surest practical way of identifying the disease, and the test should be applied to any suspicious-looking cells which may appear amongst the brood. I would here point out that, although the cappings of brood, particularly

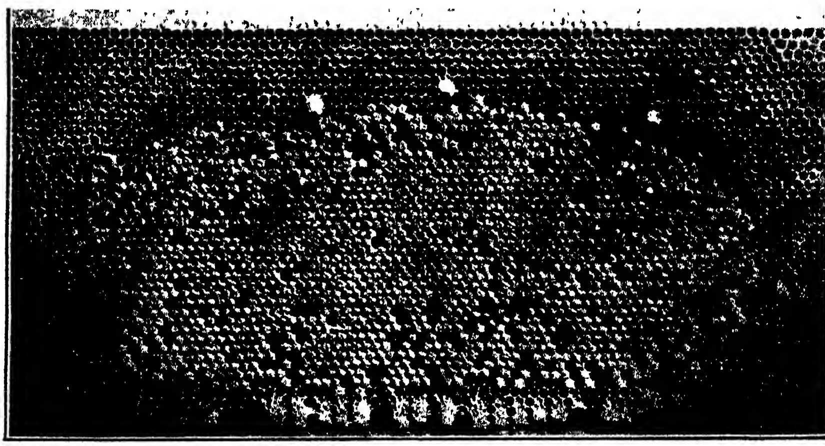


Fig. 1.—Comb of healthy brood; queen cells also shown.

those of black bees, have, when healthy, the appearance shown in Fig. 1, there are some bees of the yellow races which cap the cells quite flat; also, that the scattering of the brood is by itself not necessarily an indication of disease, and may be due to the irregular laying of an inferior queen.

In view of the heavy losses resulting from foul-brood, when once it has obtained a good start in an apiary, and the great amount of labour involved in its eradication, as well as to the fact that it has now been proclaimed a disease under the *Bees Act* 1910,* it is desirable that every owner of bees should be able to recognise this disease when it appears in one or more of his hives. He will then be able to deal with it before it has made any great headway.

* Under the *Bees Diseases Act* 1910 it is provided that the Governor in Council may by proclamation, declare as disease any pest, &c., for the purposes of the Act In this respect Foul Brood *Bacillus alvei*, Brood Pest *Bacillus larvæ*, and Sour Brood *Streptococcus apis* have been so proclaimed. By the Act an inspector is empowered to enter and inspect any premises where bees are kept, and take such action as is necessary to arrest the spread of disease by cleansing or disinfecting or destroying such articles or appliances, or bees, hives, comb, or honey as are likely to spread disease; and any owner neglecting to carry out the directions of an inspector is liable to a penalty for an offence against the Act. On and after 1st January, 1918, any district may be proclaimed a district in which no bees shall be kept except in certain prescribed hives.

Unfortunately, there are still many bee-keepers who do not discover the presence of this disease amongst their bees till the small number of bees in several of the hives indicates that there is something wrong. When hives have been affected sufficiently long to show marked decline in the number of bees, the disease is likely to spread rapidly; the remaining bees are usually inactive, and do not defend their hives against robber bees from strong healthy colonies, which in turn fall victims to foul-brood. It is, therefore, important that vigilance should be exercised whenever combs are handled, so that the disease may be discovered and treated when still in its first stage.

When foul-brood is discovered, the affected hive should be at once covered up again to prevent attracting robber bees from other hives; and unless the colony is still strong in bees the entrance should be contracted to from 1 to 3 inches in width, so that the diseased colony may be better able to defend itself against robbers. The brood in the other hives of the apiary should be carefully examined, taking care not to attract robbers by leaving a hive open too long or performing

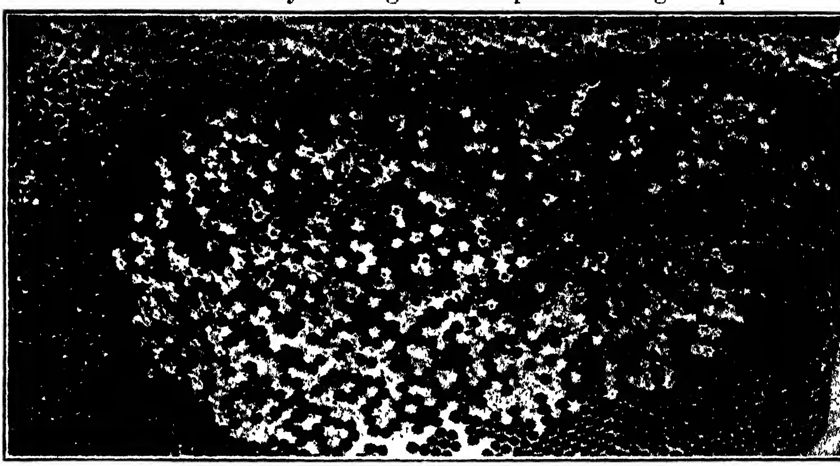


Fig. 2.—Comb of diseased brood, showing flat, sunken, and perforated cappings.

the examination at unsuitable times. If more cases are found, the hives should be marked and treated at the first favorable opportunity.

To successfully cure a colony of foul-brood three conditions are necessary, viz., first, there should be sufficient bees in the diseased colony to form a small swarm; second, the weather should be mild or warm; and third, honey should be coming in. If sufficient bees are not left in a diseased colony to build combs and to raise sufficient brood to increase the worker force, no cure should be attempted; it will be found more profitable to at once destroy by fire the bees, combs, and frames.

Warm weather is required to enable the bees to secrete wax and rear brood, and therefore bees cannot be treated before September or after March. A honey flow is essential, so that bees treated may not be robbed during or after treatment.

The only reliable method of getting rid of foul-brood without destroying the entire diseased colony is to remove the bees from their infected surroundings and start them afresh in a clean hive.

This is done by putting a clean hive with frames supplied with starters of comb foundation on the spot occupied by the diseased hive, removing the latter to a little behind the former. A cloth or bag is placed in front of the clean hive, on to this the bees are rapidly shaken and brushed from the diseased combs. If they do not readily enter the new hive, a little smoke may be used to drive them in. The bees will now start comb-building; the honey which they brought from the diseased combs in their honey sacs will be consumed in the secretion of wax, and the colony will now be free from disease, unless it is re-introduced into the hive from outside. To prevent the bees swarming out and absconding, as they will sometimes do when suddenly deprived of their brood, queen-excluding zinc may be fastened over the entrance, so that when the bees swarm out the queen cannot follow, and the swarm will return to the hive. This obstruction should, however, be removed in four or five days, when the bees will have settled down.

The diseased hive, floor, cover, and frames of comb, should be taken indoors as soon as the operation of shaking down is finished, and effectively secured against access by bees. The combs and frames should be at once destroyed by burning. The hive, hive floor, and roof should be thoroughly cleansed by immersing and scrubbing in boiling water containing washing soda and soap. When clean, the hive should be exposed to the atmosphere to dry thoroughly, after which it may again be used for housing bees.

When only a few diseased cells are found in a number of hives, the strongest of them may be treated first, and the brood combs given to the other affected colonies in a super over a queen-excluding honey board. In ten days most of the healthy sealed brood will have hatched, increasing the worker-force of the remaining diseased colonies, which may now also be cured by the shaking-down method described before.

To completely destroy a diseased colony which is too weak to be cured, close the entrance of the hive when the bees have ceased flying towards evening. Put sufficient wood, ready for lighting, into a hole dug for the purpose, place the hive on the fuel and set fire to it. When burned down, fill up the hole with earth. The combs removed from hives shaken down should be destroyed in the same way, otherwise there may be difficulty with bees getting access to honey which remained unconsumed by fire.

Observance of the following rules will greatly assist bee-keepers in the prevention of foul-brood and its eradication when present in the apiary:—

1. Have no queenless colonies; they will not defend their hives, and will thus establish robbing habits in the apiary.

2. Do not allow bees to have access to honey, combs, wax, or hive refuse, even when quite free from disease; bees should know of no other source than the nectar of flowers.

3. Never feed honey to bees; it may contain disease germs; it excites them and induces robbing. Sugar syrup is safer, cheaper, and just as good for feeding.

4. Do not try to cure foul-brood by requeening alone, or by doctoring diseased cells, or cutting them out. It will only delay the course of the disease, but will not cure it.

5. When examining combs for disease, do not use your finger nail to open the cells, but a match, toothpick, or straw. Use a fresh one for each hive, and burn those used.

6. Do not try to cure the disease by giving the bees medicated food. Any drug given strong enough to destroy the germs of foul-brood would kill the bees.

7. Do not interchange combs between different hives while there is disease in the apiary.

8. If bad weather should set in after a diseased colony has been treated, feed sugar or syrup (1½ sugar to 1 water) inside the hive.

(*To be continued.*)

INDIAN RUNNER DUCKS AND EGG PRODUCTION.

A correspondent forwards some interesting facts about his Indian Runner ducks and egg production. For the twelve months ending 31st March last, one pen of twenty-five birds laid 5,561 eggs, of the wholesale value of £30 2s. 6d. The record was kept of only one of the pens, probably the other pens did equally as well. The birds were hatched early in October, 1911, and began to lay early in March, 1912. The monthly record is as follows:—

				£	s.	d.
1912.—April	..	612 eggs, wholesale value	..	4	9	3
May	.	652 ,, ,, ,,	..	5	0	0
June	..	483	..	3	10	0
July	..	301 ,, ,, ,,	..	1	18	0
August	..	315 ,, ,, ,,	..	1	7	7
September	..	535 ,, ,, ,,	..	2	2	2
October	..	651 ,, ,, ,,	..	2	13	0
November	..	594 ,, ,, ,,	..	2	9	6
December	..	463 ,, ,, ,,	..	2	3	2
1913.—January	..	432 ,, ,, ,,	..	1	15	7
February	..	342	..	1	13	7
March	..	181 .. ,, ,,	..	1	0	8
				£30	2	6

EDITOR'S NOTE.

GROWING LUCERNE FOR SEED—

Owing to its high price, a good crop of seed lucerne yields splendid returns to the grower, but in ordinary cases the crop is an uncertain one. American experience in this regard is interesting, and the subject is discussed in *Farmers' Bul.* 495, issued by the U.S. Department of Agriculture. It has been found that the most successful crops of seed are obtained when a relative shortage of soil moisture accompanies comparatively high temperatures while the seed is maturing. The soil moisture must be sufficient to permit the setting of seed, but not great enough to start new vegetation for the succeeding crop. "This narrow margin is the principal cause of the great uncertainty in the lucerne seed crop." The best time to harvest was when the pods ranged from straw colour to brown.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 239.)

By S. A. Cock, Orchard Supervisor, Bendigo.

PART III.—STOCKS.

The unsuitability of a stock to local conditions of soil and drainage has been a great factor in the loss of a large number of trees. In the past the common lemon has been chiefly used. Seedlings, layers, and cuttings, the last two have been failures; the seedling will thrive and produce a good tree with heavy crops; but at an age of ten to fourteen years root-rot will overtake the majority of trees planted on the lemon stock, even under the most favorable conditions of soil and drainage. The stock is unsuitable. The orchard costs a lot of money to establish,

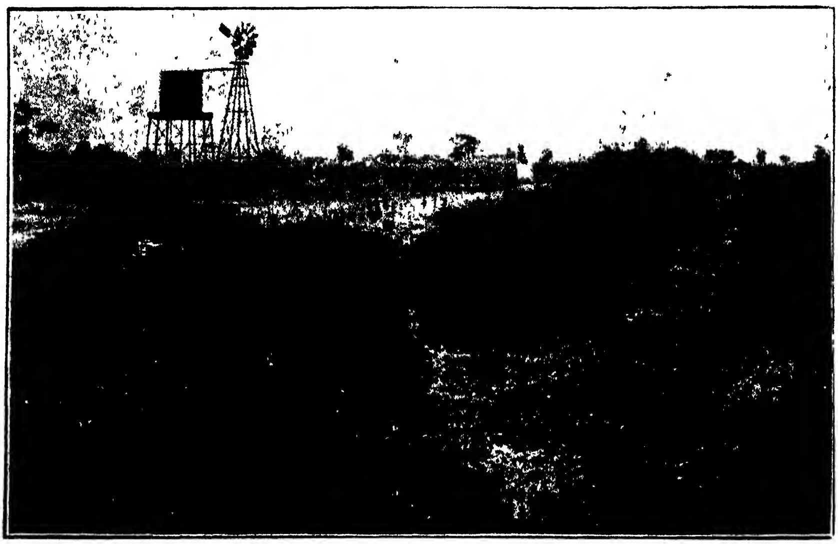


Plate 12.—Twelve years old Orange Grove, Kyabram.

therefore it is necessary that the trees shall last and remain profitable, consequently suitable stock must be obtained.

Planters should secure trees worked on the Seville (*Citrus bigaradia*) or the sweet orange (*Citrus dulcis*) stock. The sweet orange is an admirable stock on which to work, and gives great satisfaction in perfectly drained soils; it is subject to root-rot, but in a far lesser degree than the lemon. Oranges and lemons worked on the sweet orange stock make large trees, bear prolific crops, and excellent quality fruit under congenial soil conditions. The Seville orange is undoubtedly the most suitable stock, adapting itself to all classes of soils. and withstanding irrigation conditions extremely well in all situations. Oranges and lemons worked on this stock are thrifty in their habit, prolific in bearing, and the stock is almost immune from root-rot. Plate 14 represents three-year-old Washington Navels on Seville stock at White Hills. Bendigo.

Citrus trifoliata is also used for stock in very wet situations. Commercially it is a failure; the trees are too slow in growth; it also has a very dwarfing effect on the scion, and is generally unsuitable.

The Echuca seedling, Plate II., raised at Echuca by Mrs. Lilian Johnson, promises to become a good stock. Trees thirty years of age show no sign of root-rot at Echuca.

PROPAGATION.

Seeds should be planted in September and October. Seeds are obtained by allowing the fruit to rot in heaps or in barrels, and when decayed sufficiently to break easily by handling should be thoroughly washed through a coarse sieve. The decaying substance of the fruit is passed through the sieve and the seed left behind. The seed should then, before drying, be placed in moist sand; this can be done by making a box 2 feet square and 6 inches deep, fill it half-full of sand, and on this place a layer of seeds 2 inches deep, and fill up the box on the seed layer with more sand, then thoroughly mix the seed and

Plate 13.—Five years old Washington Navel Trees; average yield for orchard, 3 cases to the tree (1911).

sand together by stirring with hand; this is done to cover the seeds with sand and prevent them from sticking together. When the seed and sand have been thoroughly mixed, the box can be filled up with sand and stacked. When ready to plant, the seeds and sand are passed through a sieve, and the seed recovered. The seed bed should be made under cover of lattice work or wooden screen. The soil should be deep, rich loam, well drained. The seed should be sown in drills 2 inches deep and 9 inches apart, with about 3 inches between each seed. The seed should then be covered to 1 inch deep, and care taken through the growing season to keep young plants continually growing; this is done by frequent watering, and cultivation between the young seedlings, and proper protection from cold winds and scorching sun. At the age of one year the forward young seedlings can be transplanted to the nursery rows, 5 feet apart and 15 inches apart in the row. Backward or small delicate seedlings should be transplanted into very sheltered nursery rows, or allowed to remain for another year before transplanting. The seedlings should be allowed to remain

at least one year in the nursery bed, and allowed to grow at will, and in November, December, January, or February, when the sap is running free, budding takes place. Buds should be selected from round matured wood, with as few thorns as possible. The leaves should be removed by cutting, and the bud inserted for oranges not less than 4 inches above the ordinary soil level; and for lemons not less than 6 inches. The reason for this is to preserve the scion against any possibility of collar-rot, which is nearly always brought about by wet

Plate 14.—Three years old Washington Navel on Seville Stock, White Hills, Bendigo.

earth, or water lying against, or coming in contact with the susceptible lemon and sweet orange; also to prevent roots being thrown out by the scion and thereby inducing root-rot.

Budding is done as follows:—A vertical cut with a sharp budding knife is made in the bark of the stock at the desired height 1 inch long (Fig. 1, Plate 15) into the cambium layer; a transverse cut is then made at the top of the vertical one (Fig. 2, Plate 15); the point of the knife is then inserted and the bark held back, as at Fig. 3, Plate 15, and the bud carefully pushed down, and the lifted edges of the

bark brought back again over the inserted bud, as at Fig. 4, Plate 15, and then tied with raffia or binding twine, as at Fig. 5, Plate 15. The wood from which the buds are taken should be held with the point of the bud looking toward the body, and the bud cut from behind, as at Fig. 6, Plate 15; the bud should be cut 1 inch long, starting ½ inch above the bud, and finishing ½ inch below, as shown. Cut with a sharp knife, cutting deep enough to remove a very thin and smooth piece of wood on the underside of the bud, as shown at Fig. 7, Plate 15, back view of bud. Fig. 8, Plate 15, shows front view of prepared bud. When inserting the bud be careful not to injure it; hold the bud between the thumb and forefinger, and gently press it into the prepared incision. When the bud has taken, the stock should be shortened, as at A.A., Fig. 9, Plate 15. This is to prevent a check in sap flow, which may injure the bud. Later on, when the bud is growing, the head of the stock is further removed, as at Fig. 10, Plate 15, and the delicate growing shoot tied to it to protect it, as at A.B., Fig. 10, Plate 15, and, when strong enough, the remaining portion of the stock is cut off, as at C., Fig. 10, Plate 15, and the cut waxed over.

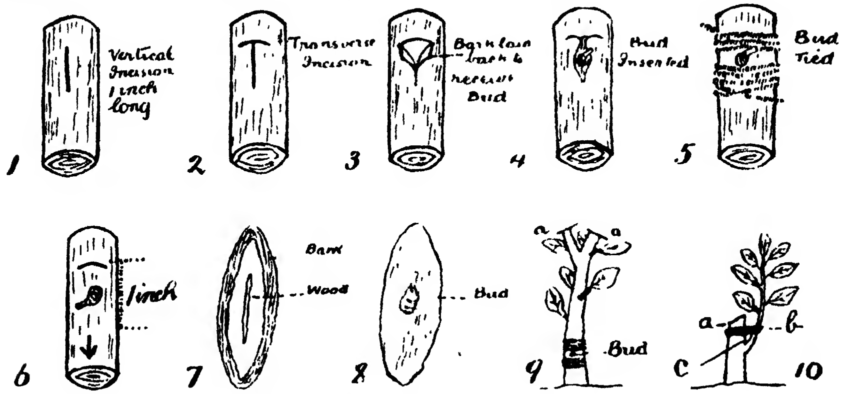


Plate 15.—Budding.

When the buds begin to move about three or four weeks' growth should be allowed before the string tying the bud should be cut. The buds are allowed to grow until they show signs of bending at the top; they are than pinched at the top; this arrests growth, and starts new growth from lower buds. The strongest is selected, and the others removed with a sharp knife. This growth is again pinched in turn, when drooping or bending of the head takes place; and if the tree is advanced sufficiently in height, pinching again takes place to form the head at the desired height. From the resultant growth the vertical is removed, and the tree shaped to three or four horizontalized branches.

In budding old trees it is best to cut back a portion of the tree, start a new growth, and bud on to it. When the buds are started, the remaining portion of the tree can be removed, and on further new growths more buds inserted if necessary.

Buds inserted in the autumn remain dormant until the spring, and become active with the new growth of the tree. Budding may also be carried out in spring.

Growers should insist that none but strong, healthy, well-grown trees should be supplied to them. Too many weaklings and culls are sent out from the nurseries. A grower by producing his own trees will have many advantages in selecting scions from his most fruitful and strongest trees, and working on to selected suitable stocks.

PLANTING.

There are two systems of planting in Victoria—the square and the septuple, the square being the more generally adopted. The three general distances for planting are 20 feet, 22 feet, and 24 feet. Citrus trees require plenty of room for growth and cultivation, and the square system, 24 feet x 24 feet, will be found the most advantageous. If planting alongside deciduous trees, which are generally planted 20 feet x 20 feet, it would be advisable, in order to avoid a break in the continuity of the lines of trees, to adopt a general distance for citrus and deciduous of 22 feet x 22 feet. The following table will give the number of trees to the acre for the three distances named on the square and septuple systems:—

Distance apart	Number of Trees Square System	Number of Trees Septuple System	Distance in check row Septuple.
			feet inches.
20	109	125	17 $3\frac{7}{8}$
22	90	103	19 $0\frac{5}{8}$
24	76	86	20 $9\frac{3}{8}$

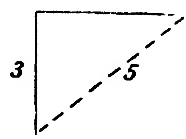
To find the number of trees to the acre on the square system, multiply the distance apart and divide the result into 43,560, the number of square feet in an acre, thus 20 feet x 20 feet $= \frac{43,560}{20 \times 20} = 109$. To find the number of trees on the septuple system, find the number to the acre on the square system, and add 15 per cent.

In laying out the orchard on the square system, and assuming (Plate 4) the block to be a rectangle, as shown, the first work to be done is to thoroughly and deeply plough the area to be planted. The ground should then be harrowed down thoroughly, and rolled and graded. After this preparation, which should be carried out in early autumn, the situation for the head ditch should be determined and the ditch prepared, also other distributary channels of a permanent character. Furrows should then be struck out, and water run in them to find out any irregularities in surface grading. A trial run of water over any surface after grading is work well repaid. The success of culture under irrigation lies in the equal distribution of water over any surface.

Deep thorough cultivation of any ground is essential for the successful growth of orchard trees, specially citrus. A good healthy start generally insures a prosperous career. Trees require all the essentials so necessary to the successful cultivation of any plant—a properly prepared soil. After any trial run of water and subsequent rectifying of surfaces, a good cultivation is necessary, and in August the area to be planted should be marked out. Having determined the

distance the trees are to stand apart, strike out a base line, leaving a distance of at least 20 feet for a headland. This will be found of great benefit in future working of the orchard. Good headlands should be left all round the orchard. The base line is best struck out by a length of No. 10 fencing wire, looped or ringed at each end and notched with solder at the distances the trees are to stand apart, thus—

The base line should run parallel with any known straight line, such as a fence, road, or channel. The wire should be securely fixed by using two crowbars, one at each end *a*——————————*b*, by passing the bar through the loops; securely fix one bar in the ground, and when the wire is drawn tight, securely fix the other. If it is necessary to find the right angles, use the process of 3—4—5, or any multiple of it, thus:—



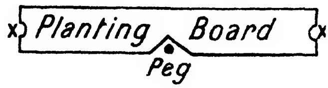
3—4 form the right angle lines; 5 the diagonal line. When the base line is struck and the wire drawn tight, pegs should be placed in the ground at the notches on the wire; pegs should be 1 foot long, and driven into the ground 6 inches; when the right angle line is found, the line should be similarly pegged. It will be found advantageous to peg the square, and then proceed with the filling lines, pegging out the whole orchard. The marking out wire should be the length of the longest line. By this process trees should be in perfect line in any direction. The square system is the best system for working under irrigation conditions, and should be generally adopted.

When the trees are received from the nurseryman at planting time, they are generally sent as shown in Plate 16. The trees are removed from the nursery after the winter's growth has hardened, and been balanced by a subsequent root growth. This is the condition for new head growth. Just before this starts, the fine roots on one side of the tree, and the tap root, at a fair depth below the surface, are cut with a sharp spade; the earth is then returned to the cut surface, and the trees allowed to form crown growth on the cut rootlets and tap root. This usually takes a fortnight; then the remaining roots can be cut, and the tree removed. This treatment prevents shock to the young trees in removal. The soil is then shaken from the roots, and the roots dipped immediately into thin mud puddle, and then the roots of the trees packed tightly in the boxes in moist sawdust and despatched without delay to the grower. The grower, on receiving the package, should remove the hessian covering, and keep the packed trees in a cool shaded situation, occasionally sprinkling the trees, to keep the package moist, until ready for planting.

When planting is to take place the trees should be removed from the package as required, and the roots thoroughly washed of mud puddle; all broken roots should be removed by cutting with a sharp

knife, and the roots thrown into balance as much as possible. Figs. 1, 2, Plate 17, represent the treatment of roots. In Figs. 1, 2, Plate 18, there were large broken roots; they have been removed, and balance made, as shown (Plate 17). The trees should then be wrapped in a wet sack, and each tree kept covered until planted.

In planting, a board is used, made thus—



3 feet long, 6 inches wide, and 1 inch thick, and notched in the centre. The board is placed on the ground, with the peg already in the ground fitting exactly in the extreme angle of the notch, as shown, and then two pegs are driven at either end of the board, as shown by X, and the board and centre peg removed, and the hole excavated inside the pegs

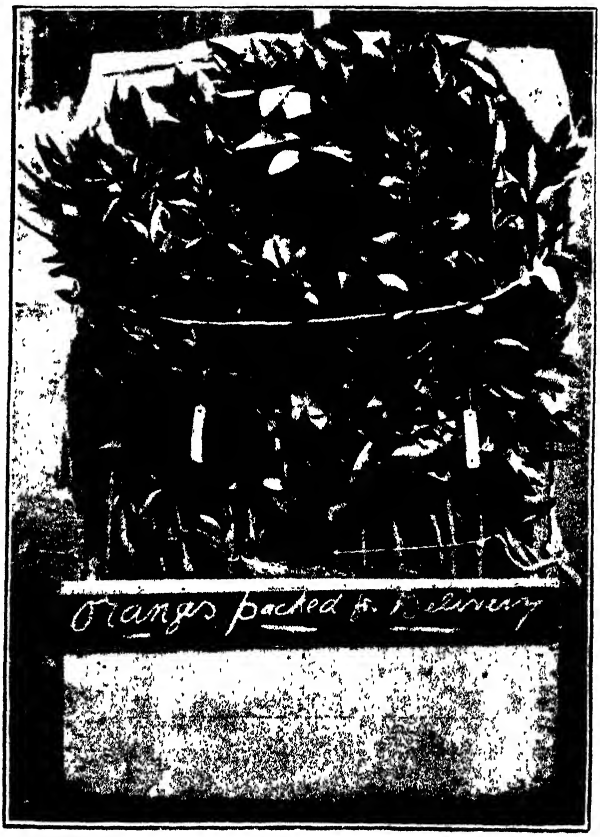


Plate 16.—Orange Trees packed for transport.

marked X; the hole for the reception of the tree should be large and fairly deep, 3 feet nearly in diameter and 10 to 12 inches deep. The soil is then returned to the centre of the hole in the form of a mound, and on this the tree is planted. The planting board is now brought into use again, being fixed, as before, inside the two pegs marked X,

on the ordinary soil level, and the tree should then be fixed in the notch occupying the same position the original marking-out peg held. The tap root of the tree should then be placed in the mound and earth returned, the small roots carefully placed, as equally spaced as possible, and more soil returned, until the roots are covered. If the tree is standing too low it should be gently worked up through the soil, returning more earth until the roots are covered. Planting a little

Plate 17.—One and two year old Trees pruned head and root and prepared.

deep and working the roots up through the returned soils is a system generally adopted in planting. The tree should stand in the hole, when planted, with the surface soil mark on the stock (indicating the depth it stood at in the nursery) standing 6 inches above the ordinary soil level. The tree should then be staked and tied; the stake should be made of redgum 3 feet long and 1½ inches square. If hardwood stakes are used, they should be dipped in tar, for a depth of 1 foot,

before driving in the ground. The stakes are placed on the south-west, the windward side of the tree, about 6 inches away, and the tree tied to the stake with raffia or hayband, at a height of 1 foot from the ground, tying tight on the stake and loose around the tree. The hole should then be filled up with water, and when the water has drained away, the remainder of the soil should be returned; the soil will then

Plate 18.—One and two year old Trees before head and root pruning for planting.

assume the shape of a mound 6 inches high. This will compact to about 3 inches above the ordinary soil level, and will keep the scion well above any wet soil surface. The water placed in the hole at planting time consolidates the earth around the roots, and does away with the harmful practice of tramping with the feet, and the stake holds the tree firm in its position. Fig. 1, Plate 19, shows the planting

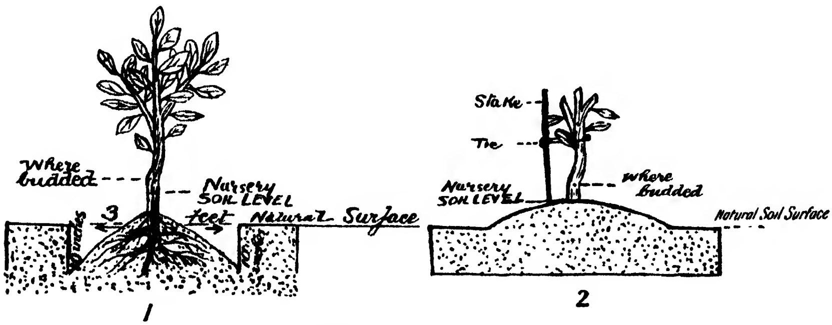


Plate 19.—Planting.

1 2

Plate 20.—Planting.

and placing of roots. Fig. 2, Plate 19, the tree planted, mounded, and staked.

It requires two men to plant trees properly—one to hold the tree and fix the roots, the other to return the earth as required. Two men should dig the holes, plant, stake, and water, also return the earth on 1 acre of trees per day. Planting is work that requires care and attention, and it does not pay to rush.

Other methods of planting are the ball and pot system. The balled trees are removed with the earth undisturbed around the roots of the trees, and the ball of earth is tied in a piece of hessian, as shown in Fig. 2, Plate 20, and requires to have only the string cut at the time of planting; the hessian soon rots in the ground. These trees, if properly lifted, require no pruning at planting, as the roots previously cut and crowned with callus, receive no check. The potted tree, as shown in Fig. 1, Plate 20, is the ordinary tree lifted from the nursery with bare roots, placed in a pot, packed with new earth, and new root growth forced by bottom heat under glass for about three weeks, and then the growth hardened off under ordinary glass conditions for six or eight weeks, and still further hardened under ordinary cover, and sent out for planting, as illustrated. In planting out, the tree is simply removed from the pot and planted in the soil. These trees generally require no head pruning at planting, as they receive no root check. In commercial orcharding nothing is gained by balling or potting. If the conditions of planting out bare-rooted trees are carried out as described and all wasty and weakling trees discarded at planting, there should be no failures. Lemons are more delicate than oranges, but both require equally careful treatment. Bandaging the butts of the trees with hessian or paper is not a necessity, and wire netting renders the orchard proof against rabbits. Potted and balled trees are suitable for persons growing only one or two trees, and who do not understand pruning methods.

(To be continued.)

THE TUBERCULOSIS INQUIRY—

The British Royal Commission on Tuberculosis which has been sitting for nearly twelve years, has now issued its final report. The commission was appointed after a declaration in 1901 by Dr. Koch that "human tuberculosis differed from bovine, and cannot be transmitted to cattle"—a statement which, if proved, had an obvious bearing upon legislation calculated to prevent the spread of the disease. The commissioners deal with this and the other points referred to them. In a first interim report, dated June, 1904, they found that tubercle of human origin can give rise in the bovine animal to tuberculosis identical with ordinary bovine tuberculosis. In a second interim report of February, 1907, they state that cows' milk containing bovine tubercle is clearly a cause of tuberculosis and of fatal tuberculosis in man. In the final report now issued, the commissioners recommend drastic action to prevent meat and milk affecting human beings, the isolation of highly-infectious cases, better housing and special separate treatment for children, and the appointment of an advisory council to assist the Government.

SUPPLEMENTARY LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. In-soluble.	Phosphoric Acid. Total.	Potash.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	%	%	%	£ s. d.	
Blood and Bone ..	Union Jack ..	6 11	..	2 51	5 00	7 51		6 5 0	N. Dale, Bentleigh
Bone and Blood, No. 1 ..	Hasell's .. .	7 50		5 50	5 00	10 50	.	7 10 0	A. H. Hasell. Melbourne
"Blood and Bone Fertilizer"	G-D . .	6 27		3 90	4 35	8 25		6 5 0	Gippsland Co-Op. Bacon Curing Coy. Ltd., Dandenong
Bone and Superphosphate, No. 1	Elsworth's ..	1 00	8 00	3 00	7 00	18 00	.	5 7 6	The executors J. R. Elsworth. Ballarat East
Bone and Superphosphate, No. 2	" .	0 80	12 00	1 00	5 00	18 00	.	5 2 6	" " " " "
Bone-Superphosphate ..	Gardiner's	1 25	8 00	3 20	5 80	17 00		5 0 0	Geo Gardiner Coy. Pty. Ltd., Marshalltown, Geelong
Bone Fertilizer	Eagle . .	3 25		8 95	10 30	19 25	.	6 5 0	E. T Hoskin. Eagle Point. Bairnsdale
Indian Ocean Natural Guano	Hasell's. .	0 50		6 00	23 00	29 00		4 0 0	A. H Hasell. Melbourne

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Mechanical Condition. Fine.	Mechanical Condition. Coarse.	Price asked for Manure per ton.	Where Obtainable.
		%	%	%	%	£ s. d.	
Bone Dust	J.N.D B ..	4 23	20 87	37 00	63 00	5 15 0	J. N. Day, Bendigo
Bone Dust .. .	Lion . .	3 85	21 50	31 00	69 00	6 10 0	A. Wray, Sale

Agricultural Laboratory,
Melbourne, 9th April, 1913.

P RANKIN SCOTT,
Chemist for Agriculture.

LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES COLLECTED IN VICTORIA UNDER THE PROVISIONS OF THE ARTIFICIAL MANURES ACT.

Label No.	Description of Manure.	Manufacturer or Importer.	Moisture.	Nitrogen.		Phosphoric Acid.								Potash.		Price asked for the Manure per ton.		
						Water Soluble.		Citrate Soluble.		Insoluble.		Total.						
			Found.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.			
			%	%	%	%	%	%	%	%	%	%	%	%	%	£	s.	d.
1039	Nitrate of Soda ..	Cuming, Smith and Co.	..	15·60	15·50									..		14	10	0
1076	Superphosphate, Federal	Australian Explosives and Chemical Co.	5·64	..	.	16·24	17·00	0·97	1·00	2·32	2·00	19·53	20·00	..	..	4	7	6
1051	Superphosphate, Florida ..	Cuming, Smith and Co.	6·09	..	.	17·09	17·00	0·61	1·00	2·15	2·00	19·85	20·00	..	.	4	7	6
1064	" "	" " "	7·71	..	..	17·05	17·00	0·77	1·00	1·60	2·00	19·42	20·00	..	..	4	7	6
1068	" "	" " "	7·06	..	..	19·10	17·00	0·75	1·00	0·79	2·00	20·64	20·00	.	..	4	7	6
1072	" "	" " "	5·96	..	..	18·57	17·00	0·79	1·00	0·96	2·00	20·32	20·00	..	.	4	7	6
1077	" "	" " "	7·51	..	..	18·00	17·00	0·71	1·00	1·14	2·00	19·85	20·00		..	4	7	6
1080	" "	" " "	6·38	..	.	18·55	17·00	0·56	1·00	0·76	2·00	19·87	20·00	..		4	7	6
1067	Superphosphate, M.L. ..	Mt. Lyell M. and R. Co.	8·38	..	..	20·19	17·00	0·50	1·00	0·27	2·00	20·96	20·00	..	..	4	7	6
1071	Superphosphate, No. 1	" "	5·35	..	..	18·66	17·00	0·33	1·00	1·51	2·00	20·50	20·00	.		4	7	6
1075	" " ..	" "	8·34	.	..	19·49	17·00	0·97	1·00	0·26	2·00	20·72	20·00	..	.	4	7	6
1078	Superphosphate, M.L. ..	" "	6·90		..	19·68	17·00	0·88	1·00	0·44	2·00	21·00	20·00	.		4	7	6
1084	" " ..	" "	8·22		..	20·05	17·00	0·25	1·00	0·30	2·00	20·60	20·00	..	.	4	7	6
1062	Superphosphate, No. 1 ..	Wischer and Co.	5·91	..	..	18·22	17·00	1·89	1·00	1·49	2·00	21·60	20·00	..	..	4	7	6
1066	" " "	" " ..	6·09	.	..	18·28	17·00	0·75	1·00	1·63	2·00	20·66	20·00	..	..	4	7	6
1073	" " "	" " .	6·41	.	..	18·41	17·00	0·49	1·00	1·72	2·00	20·62	20·00	.	.	4	7	6
1074	" " "	" "	9·24	..	..	18·06	17·00	0·49	1·00	1·84	2·00	20·39	20·00	..	..	4	7	6
1069	Bone and Superphosphate (Federal)	Australian Explosives and Chemical Co.	3·71	0·65	0·75	12·72	12·75	1·20	0·75	6·24	5·50	20·16	19·00	..	..	5	5	0
1057	Bone and Superphosphate	J. Cockbill .. .	6·51	1·79	1·50	13·30	12·75	0·15	1·50	5·62	4·75	19·07	19·00	..	..	5	5	0
1082	Bone and Superphosphate, C	Cuming, Smith and Co	7·70	1·05	0·75	12·36	12·75	2·00	0·75	5·56	5·50	19·92	19·00	..	..	5	5	0
1048	Bone and Superphosphate	A. H. Hasell .	6·51	1·18	0·80	12·78	12·75	1·40	1·25	5·62	5·50	19·80	19·50	..	..	5	4	0
1063	Bone and Superphosphate, No. 1	Wischer and Co. .	5·36	1·82	1·50	8·38	8·50	4·01	0·50	8·81	10·00	21·20	19·00	.	..	5	7	6
1070	" " "	" " .	7·37	1·77	1·50	8·65	8·50	2·36	0·50	8·49	9·00	19·50	18·00	..	..	5	12	6
1081	" " "	" " ..	5·81	1·64	1·50	8·50	8·50	2·31	0·50	8·56	9·00	19·37	18·00	..	..	5	12	6
1050	Nitro Superphosphate ..	Cuming, Smith and Co.	5·36	1·59	1·39	16·59	14·28	0·64	0·84	4·33	2·22	20·56	17·34	..	..	5	0	0
1079	Blood Manure ..	" " ..	15·29	8·40	7·50	.	.	..	.	1·16	1·00	1·16	1·00	..	..	6	10	0
1065	Bone Fertilizer ..	J. Cockbill ..	4·65	4·04	3·50		.	3·89	3·50	14·04	14·75	17·93	18·25	.	.	5	10	0
1052	" " ..	Cuming, Smith and Co	5·36	2·93	3·00		.	7·41	3·50	10·19	14·50	17·60	18·00		.	5	17	6
1061	" " ..	Wischer and Co. ..	4·35	3·42	3·00	.	.	7·76	3·50	10·68	14·50	18·44	18·00	..		5	17	6
1056	Fodder Crop Manure ..	Mt. Lyell M. and R. Co.	12·17	2·73	3·00	12·79	11·00	0·24	1·25	0·85	1·75	13·88	14·00	2·00	1·00	6	7	6
1058	Maize Manure ..	Cuming, Smith and Co	9·72	2·18	2·38	14·63	13·94	0·77	0·82	2·67	1·64	18·07	16·40	1·84	1·80	6	0	0
1059	Potato Manure ..	" "	10·05	1·21	1·20	15·24	14·62	0·65	0·86	2·61	1·72	18·50	17·20	4·70	4·16	6	7	6
1053	" " .	Mt. Lyell M. and R. Co.	9·56	1·15	1·20	16·50	14·50	0·24	1·00	0·96	1·70	17·70	17·20	3·89	4·15	6	7	6

LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES COLLECTED IN VICTORIA UNDER THE PROVISIONS OF THE ARTIFICIAL MANURES ACT—*continued.*

Label No.	Description of Manure.	Manufacturer or Importer.	Moisture.	Nitrogen.		Phosphoric Acid.		Mechanical Condition.				Price asked for the Manure per Ton.
								Fine.		Coarse.		
			Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	
			%	%	%	%	%	%	%	%	%	£ s. d.
108	Bonedust	Richards, F. W.	4·12	2·50	2·83	24·30	24·86	60·0	63·0	40·0	37·0	5 0 0

Agricultural Laboratory,
Melbourne, 9th April, 1913.

P. RANKIN SCOTT,
Chemist for Agriculture.

Wool contains suint, fat, and pure wool hair. The suint consists chiefly of a potash compound, and is mostly removed when sheep are washed. The suint may form more than half the weight of the fleece, or may be only 15 per cent. The fat is not removed by washing, and may vary from 30 to 8 per cent. of the washed fleece.

STATISTICS.

AGRICULTURE IN VICTORIA.

AREA AND PRODUCE, 1911–12 AND 1912–13.

The following returns for the State of Victoria have been issued by the Government Statist (Mr. A. M. Laughton) :—

Name of Crop.	Area.		Produce.		Average per acre.	
	1911–12.	1912–13.	1911–12.	1912–13.	1911–12.	1912–13.
	Acres.	Acres.	Bushels.	Bushels.	Bushels.	Bushels.
Wheat	2,164,066	2,085,216	20,891,877	26,223,104	9·65	12·58
Oats	302,238	439,242	4,585,326	8,323,639	15·17	18·95
Barley (malting)	36,748	52,311	725,803	1,269,634	19·75	24·27
Barley (other)	16,793	19,320	298,781	474,893	17·79	24·58
Maize	18,223	19,986	792,660	*	43·50	*
Rye	1,098	1,428	9,981	17,141	9·09	12·00
Peas and beans	11,535	11,875	181,113	232,856	15·70	19·61
			Tons.	Tons.	Tons.	Tons.
Potatoes (early crop)	†5,142	5,164	17,498	19,083	3·40	3·70
Potatoes (general crop)	42,550	42,411	101,594	*	2·39	*
Mangel-wurzel	797	1,121	9,568	14,615	12·01	13·04
Beet, carrots, parsnips, turnips for fodder	658	627	4,953	*	7·53	*
Onions	3,652	4,977	20,911	28,641	5·73	5·75
Hay (wheaten)	304,388	386,370	357,370	438,829	1·17	1·14
Hay (oaten)	535,146	790,268	648,846	1,099,436	1·21	1·39
Hay (lucerne, &c.)	20,671	27,090	26,072	34,668	1·26	1·28
			Cwt.	Cwt.	Cwt.	Cwt.
Grass cut for seed	1,188	2,429	1,697	4,144	1·43	1·71
Green fodder	75,177	84,460	..		..	..
Vines	24,193	24,579				..
Orchards and gardens	59,985	63,209	..	..		..
Market-gardens	10,331	10,414		..		..
Other tillage	5,662	6,859	..	..		..
Total area under crop	3,610,241	4,079,356			..	..
Land in fallow	1,469,608	1,627,223				
Total cultivation	5,109,849	5,706,579	..	..	..	..

* Not yet available. † The early crop relates to potatoes dug before March 1.

AREA UNDER POTATOES IN PRINCIPAL COUNTIES, 1911–12 AND 1912–13.

Principal Counties.	Area in Acres. 1911–12.	Area in Acres. 1912–13.
Bourke	5,228	6,187
Grant	8,205	8,010
Mornington	5,618	5,037
Dalhousie	2,687	2,752
Talbot	6,870	6,370
Villiers	3,758	3,198
Buln Buln	3,612	4,383
Remainder of State	11,714	11,638
Total	47,692	47,575

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15*th April*, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen	Breed.	Name of Owner.	Eggs laid. April 15 to May 14	Position in Competition.
6	White Leghorns	J. S. Spotswood	126	1
46	Black Orpingtons	T. W. Coto	109	2
61	White Leghorns	Jno Campbell	108	3
2	,,	R. W. Pope	108	
21	,,	A. Ross	107	5
65	,,	E. A. Lawson	104	6
31	,,	W. G. Swift	99	7
50	,,	A. H. Mould	98	8
23	,,	J. H. Gill	95	9
66	,,	Featherstone, Wm	94	10
8	,,	E. H. Bridge	93	11
68	,,	Jones and Curtis	93	
34	,,	J. E. Bradley	86	13
49	,,	M. H. Noye	86	14
45	,,	D. Goudie	85	15
63	,,	A. Sellers	80	16
37	,,	C. H. Busst	79	17
13	Black Orpingtons	T. S. Dallimore	79	
11	White Leghorns	C. J. Beatty	78	19
59	S C White Leghorns	Cowan Bros	78	
53	Black Orpingtons	A. Greenhalgh	77	21
16	,,	D. Fisher	76	22
32	White Leghorns	H. Hanbury	76	
14	,,	F. Hannaford	75	24
47	,,	Wm. McLister	75	
40	,,	Geo. Edwards	74	26
62	,,	G. A. Gent	74	
48	,,	Thirkell and Smith	72	28
18	,,	B. Rowlinson	68	29
41	,,	Percy Walker	68	
27	,,	J. Sinclair	66	31
38	,,	M. A. Monk	65	32
7	,,	H. McKenzie	62	33
10	,,	T. A. Pettigrove	62	
39	,,	W. Purvis	62	
3	,,	W. L. Buscumb	60	36
67	,,	C. Hepburn	58	37
35	,,	Moritz Bros.	56	38
25	Black Orpingtons	King and Watson	52	39
43	White Leghorns	Morgan and Watson	52	
44	,,	W. A. Rennie	52	
19	,,	W. Dunlop	49	42
28	,,	E. Waldon	47	43
24	,,	Redfern Poultry Farm	45	44
58	,,	Stranks Bros.	45	
26	,,	B. Rolls	44	46
22	,,	B. Mitchell	43	47
52	,,	W. G. Osborne	42	48
55	,,	P. H. Killeen	40	49
12	,,	A. H. Padman	35	50
17	R.C. Brown Leghorns	S. P. Giles	34	51
57	White Leghorns	Gleadell Bros.	32	52
20	,,	C. B. Bertelsmeier	29	53
5	,,	G. W. Robbins	27	54
54	,,	Jas. McAllan	26	55
36	,,	A. J. Jones	24	56
15	,,	J. Shaw	24	
29	,,	S. Brundrett	19	58
30	Black Orpingtons	Jas. Ogden	15	59
56	White Leghorns	Schaefer Bros.	15	
42	,,	A. Stringer	15	
33	,,	South Yan Yean Poultry Farm	13	62
51	Black Spanish	W. H. Steer	13	
4	White Leghorns	Jas Brigden	12	64
9	,,	Sylvania Stud Farm	10	65
64	Golden Wyandottes	C. L. Sharman	2	66
60	Black Spanish	Watson and Rushworth	..	67
		Total	3,967	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

PLANTING.

June is the month usually favored for the planting of all deciduous orchard trees, and this work should now be carried out. The ground should have been previously ploughed, subsoiled, and drained, in anticipation of the planting of the young trees. The young trees should be planted to the same depth as they were growing in the nursery beds, and the holes for their reception should not be any deeper than is necessary to contain the roots. A deeper hole only provides soakage room for the soil moisture, and the hair roots are rotted as soon as they are formed. In order to keep the tree holes at an even depth, a plough furrow may be run along the whole length of the row, and each tree could then be planted to the depth of the furrow, and no deeper. By this means any soil moisture, or an excess of moisture, is evenly distributed, and is not likely to settle round the growing roots.

Before planting, the roots of the young tree should be well pruned, cutting them back hard, leaving a very small root system; generally only about one-third of the original roots being left.

It is rarely necessary to manure newly-planted trees when they are being planted. If manure is required, it should either have been well worked through the soil previously, or else it should be used as a surface mulch some considerable time after planting.

In planting, growers will do well to study such varieties as are valuable as export fruit in apples and pears; and other classes are generally profitable if planted for a succession. A great deal of attention is paid to new varieties, and it is to be regretted that, in the search for newer varieties, which are so often a failure, the older and more valuable varieties may be lost sight of altogether.

An up-to-date orchard should contain a very few varieties; the fewer varieties simplify many orchard operations considerably, and the crop is far more easily handled. In planting, it is also essential that the question of cross fertilization should be studied, so that the blossoming of each variety shall help the other in the setting of the fruit.

The recent Pomological Congress drew up a list of apples and pears suitable for planting in Victoria, and growers are recommended to select such as may be suitable to them from this list. The varieties are here given, and in order of preference for planting purposes.

List of apples suitable for Northern districts—

(E), early; (M), medium; (L), late; (V.L), very late.

(1) Cleopatra (M.).
(2) Dunn's Favorite (M.); Syn. Munroe's Favorite
(3) Jonathan, Gravenstein (M.).
(4) Rome Beauty (L.).
(5) Esopus Spitzenberg (L.M.), Cox's Orange Pippin (M.) (in special districts), London Pippin (M.).
(6) Peasgood's Nonsuch (E.), Wealthy (M.), Stewart's (L.), Shepherd's Perfection (M.), Scarlet Nonpareil (L.).

(7) Stone Pippin (L.).
(8) Rymer (L.), Schroeder (L.), Winter Strawberry (L.).
(9) Rokewood (V.L.).

Southern districts—

APPLES (in order of preference).

(1) Jonathan.
(2) Gravenstein.
(3) Yates.
(4) Rome Beauty.
(5) London Pippin.
(6) Shorland Queen (E.), Reinette de Canada (M.).
(7) Alexander, Wealthy (E.), Pomme de Neige (M.), Statesman (L.), Rokewood, Newman's Seedling (L.), Stone Pippin, Stewart's.
(8) Sturmer Pippin, Esopus Spitzenberg (L.), Lord Wolseley (L.), Green Alfriston (E.).

PEARS—

(1) Williams (E.).
(2) Beurre Bosc (M.), Winter Nelis (L.), Josephine de Malines (L.), Packham's Triumph (M.), Beurre d'Anjou (M.), Urbaniste (M.).
(3) Conference (M.), Winter Cole (L.), Howell (M.), Madam Cole (L.), Glou Morceau (M.L.).
(4) Kieffer (M.), Broompark (L.), Beurre Capiaumont (M.).
(5) Vicar of Winkfield (M.L.).

SPRAYING.

All the winter pests will now come in for attention, and trees should be freed, as far as possible, from all classes of scale insects, bryobia mite, woolly aphis, &c. The red oil or crude petroleum emulsion is most suitable for the eradication of these pests.

Spraying before pruning is not the general rule, and yet it seems to be the safest, especially where scales or woolly aphis are prevalent. Certainly, a much larger amount of spray material will be required, but much better work will be done. There will be no danger whatever from future contamination from any of these pests on the undestroyed prunings, or from any small clippings that may be lying ungathered around the tree. Another point in favour of this is that, if by any means, whether by careless spraying or by the use of bad materials, any part of the tree is left, so that the pest is not destroyed, and so continues to increase, then a second spraying can be given while the tree is still dormant.

DRAINING.

In old established orchards a thorough scheme of drainage does more to invigorate and resuscitate the trees than any amount of surface cultivation or manuring. The work is easier done in June and July, and, where necessary, it should be started at once. Drainage pipes are more generally used, but stones, logs, waste timber, brushwood, and charcoal are all valuable as drainage mediums. The benefits of soil drainage have been so frequently urged that it is hardly necessary to repeat them again.

POMOLOGY.

The recent session of the Pomological Congress has decided to recommend certain changes in the names of various apples and pears,

mainly for the reasons that some names are unsuitable, that some are too long, and that some contain unnecessary words.

The Congress, in considering the question of nomenclature of fruits, made no definite rules this year, but the following tentative agreements were adhered to:—

(1) That priority of name, naming, and of origin, have preference wherever possible.

(2) That such words as "Seedling" and "Hybrid" be abolished from Australian Pomology as far as possible.

(3) That simplicity of naming be followed wherever possible.

The following alterations of fruit names were recommended for the various reasons given. The new names are given first.

APPLES.

Cleopatra ..	.. Synonyms Ortley, Porter, New York Pippin of Lindley, but not of Downing.
London Pippin	.. The term Five Crown Pippin is too general, as there are many apples with such a crown, and more noticeable than this one, especially Delicious and Colville Blanche d'Hiver.
Scarlet Nonpareil	.. Synonyms Winter Pearmain and Scarlet Pearmain in Tasmania.
Adam's Pearmain	.. Erroneously called Golden Reinette and Dutch Mignonne in Tasmania.
King of Pippins	.. Synonym King of the Pippins. Erroneously known as Golden Reinette, Adam's Pearmain, and Summer Pearmain in Tasmania.
Dumelow ..	.. Synonyms Dumelow's Seedling, Wellington, Wellington Pippin.
Tasma ..	.. Synonym Democrat. A new Tasmanian apple; the name has been changed because of the existence of two American apples called Democrat.
Statesman ..	.. Synonyms Chandler's Statesman, Chandler. This is the round apple sent out by Chandler, and not the ribbed one, which he distributed earlier.
Dunn's Favorite	.. Synonyms Dunn's Seedling, Munroe's Favorite, Garibaldi, Ohinemuri. The apple being raised by Mr. Dunn, of South Australia, priority was given to his name instead of the Victorian claimant, Mr. Munroe.
Schroeder ..	.. Synonym Schroeder's Apfel. Grown in Harcourt, Vic., as Dunn's Seedling.
Stewart's ..	.. Synonym Stewart's Seedling, a Victorian seedling of Dunn's Favorite.
Reinette de Canada ..	Known as Luxembourg in Cumberland, N.S.W., and as Blenheim Orange in Tasmania.
Alexander ..	.. Synonym Emperor Alexander.
Esopus Spitzenberg ..	Synonym Esopus Spitzenburgh.
Trivett ..	.. Synonym Trivett's Seedling (N.S.W.).
Bismarck ..	.. Synonym Prince Bismarck. This is a Victorian-raised apple, and not a New Zealand variety, as stated by Hogg.

PEARS.

Williams ..	.. Synonyms Williams' Bon Chretien, Bartlett, Duchess (S.A.).
Giblin's Nelis	.. Synonym Giblin's Seedling (a Tasmanian seedling of Winter Nelis).
Kieffer ..	.. Known as Keiffer's, or Kieffer's Hybrid.

Vegetable Garden.

The principal work in this section during June is the preparation of beds for the main crop of vegetables. Most vegetables require, and thrive best in, a thoroughly well-worked soil, the soil being as friable as possible. The beds should be deeply worked; all manures should be well rotted, and evenly distributed throughout the soil.

One point to be emphasized is a good system of rotation whereby a continual succession of the different classes of vegetables is grown in the beds. This is not only valuable as a method of soil restoration and improvement, but it helps to reduce and weaken any insect or fungus disease that may have been present.

Asparagus beds may now, be renovated, and new beds planted according to directions given in the April number of the *Journal.* Onions and any other seedlings that are sufficiently far advanced may now be planted out, and succession crops of spinach, radish, peas, broad beans, leek, lettuce, carrot, &c., should be planted. The planting of rhubarb beds should now be completed.

Flower Garden.

General cleaning up and digging will be the work for this month in the flower section and shrubbery. Where the soil is heavy or sour, or where sorrel is plentiful, the garden should be given a heavy dressing of fresh lime, giving a fair dusting all over the surface. Lime should not be used in conjunction with leaves, garden *debris*, leaf-mould, stable manure, or any other organic matter used for humus. These should be first disposed of by digging well into the soil; then shortly afterwards a top dressing of lime may be given. Should no humic material be used, the lime may be dug in with the autumn digging.

In cleaning up the gardens, all light litter and dead foliage should either be dug in, or, better still, should be placed in an out-of-the-way corner to form a compost heap. Leaf-mould is especially useful in any garden, and where such plants as Azaleas, Rhododendrons, Liliums, &c., are grown, or for pot plant work, it is exceedingly valuable. In forming the compost heap, no medium whatever should be added to help the rotting down of the leaves, unless it be a little sand. Any chemical added will render the mould unsuitable for its special objects.

Any hardy annuals may be planted out, such as stocks, pansies, wallflowers, &c., and cuttings of roses and hard-wooded shrubs may also be planted.

REMINDERS FOR JULY.

LIVE STOCK.

HORSES.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down, and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley.

CATTLE.—Cows, if not housed, should be rugged. Rugs should be removed in the daytime when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows about to calve, if over fat, should be put into a paddock in which the feed is not too abundant. Calves should be kept in warm, dry shed. The bull may run with the cows.

PIGS.—Supply plenty of bedding in warm, well-ventilated styes. Keep styes clean and dry. Store pigs should be placed in fattening styes. Sows in fine weather should be given a grass run. Young pigs over two months old should be removed from lucerne run

SHEEP.—The general classing of merino and lamb-raising ewe flocks should be commenced; none but roomy thick ewes, carrying a bulky fleece, should be kept. Class rams; keep only the best in shape and fleece, castrate all others; do not allow them to go entire to be used by those who think any ram good enough. Deep and narrow forequartered rams are responsible for many carcasses dressing and freezing plainly, although often good sheep from a wool point. Sell aged or barren fat ewes from breeding flocks. Clean filth from breech of ewes of British breeds now commencing to lamb. Wherever possible, send lambs weighing 60 lbs. live weight to market. Early prices are always best; avoid waiting until the rush of the season.

POULTRY.—Mating of heavy breeds for table purposes and winter eggs should receive immediate attention. Six to eight second-season hens may be mated to a cockerel ten to twelve months old to insure fertility and strong chickens. Hatch all breeds in July and August for stock purposes. Hatch light breeds in September for winter eggs. Ten hens may be mated to one cockerel to obtain best results.

CULTIVATION.

FARM.—Finish sowing barley, peas and beans, and late white oats in backward districts. Trim hedges. Fallow for potatoes, maize, and other summer crops; in early districts, plant potatoes. Graze off early crops where possible.

ORCHARD.—Continue to plant deciduous fruit trees, bush fruits, and strawberries. Continue cultivating and pruning. Spray for mites, aphides, and scales.

FLOWER GARDEN.—Plant shrubs, climbers, and permanent plants, including roses; also annuals and herbaceous perennials, Gladioli, Liliums, Iris, and similar plants. Continue digging, manuring, trenching and liming.

VEGETABLE GARDEN.—Plant out seedlings. Sow seeds of carrots, parsnips, cauliflowers, onions, peas, broad beans, and tomatoes. Dig all vacant plots.

VINEYARD.—Proceed with pruning, burning off, and ploughing. Complete, as early as possible, the application of manures other than nitrates and sulphate of ammonia if not already done. Mark out land for new plantations. If ground is in good order and not too wet, proceed with plantations of young vines (unpruned). Remove cuttings or scions from vines previously marked, and keep fresh by burying horizontally in almost dry sand in cool, sheltered place. Permanently stake or trellis last year's plantations.

Cellars.—Rack all young wines, whether previously racked or not. Rack older wines also. For this work choose, as much as possible, fine weather and high barometer. Fill up regularly all unfortified wines. This is a good time for bottling wine.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 7. 10th July, 1913.

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(Continued from page 316.)

By E. Meeking, Senior Fruit Inspector.

PART VIII.

OVERSEA TRADE.—DISTRIBUTION AND MARKETING

TRADE CHANNELS.

At present our fruits are principally conveyed to oversea markets by vessels belonging to the following companies:—

Name of Company.	Destination	Route.
P. and O. (Mail) ..	United Kingdom	Suez
P. and O. (Cargo) ..	United Kingdom	Suez
P. and O. (Branch) ..	United Kingdom	Cape Town
Orient (Mail).. ..	United Kingdom	Suez
White Star (Liverpool)..	United Kingdom and South Africa	Cape Town
White Star (Aberdeen)..	United Kingdom and South Africa	Cape Town
Blue Funnel	United Kingdom	Suez
Federal Houlder-Shire..	United Kingdom	Suez
Norddeutscher Lloyd ..	United Kingdom	Suez
Messageries Maritimes ..	Ceylon, India and Marseilles ..	Suez
German Australian ..	Holland and Germany ..	Suez
British India	Indian Ports, Singapore, Java, Batavia, &c.	Alternative, *viâ* Sydney or Fremantle
Royal Dutch Packet ..	Singapore, Java, Batavia ..	*viâ* Sydney
Canadian Australian ..	Vancouver	*viâ* Inter-State boats, transhipment at Sydney
Oceanic S S Co. ..	San Francisco	*viâ* Inter-State boats, transhipment at Sydney
Union S S Co. ..	New Zealand Ports	Direct

In addition to the foregoing, small lots of fruit are occasionally shipped by various cargo steamers to the Pacific Islands, the East, and South Africa. The graph below shows the various countries which have been opened to our fruit trade, and those which still remain untouched. The figures showing the population of each of these countries, and the quantities of fruits shipped to same, will convey some idea of the directions in which the trade has developed since its inception some twenty years ago, and will also indicate the extent to which the trade may be further developed, both with respect to the markets already opened and those which remain untouched. It would appear

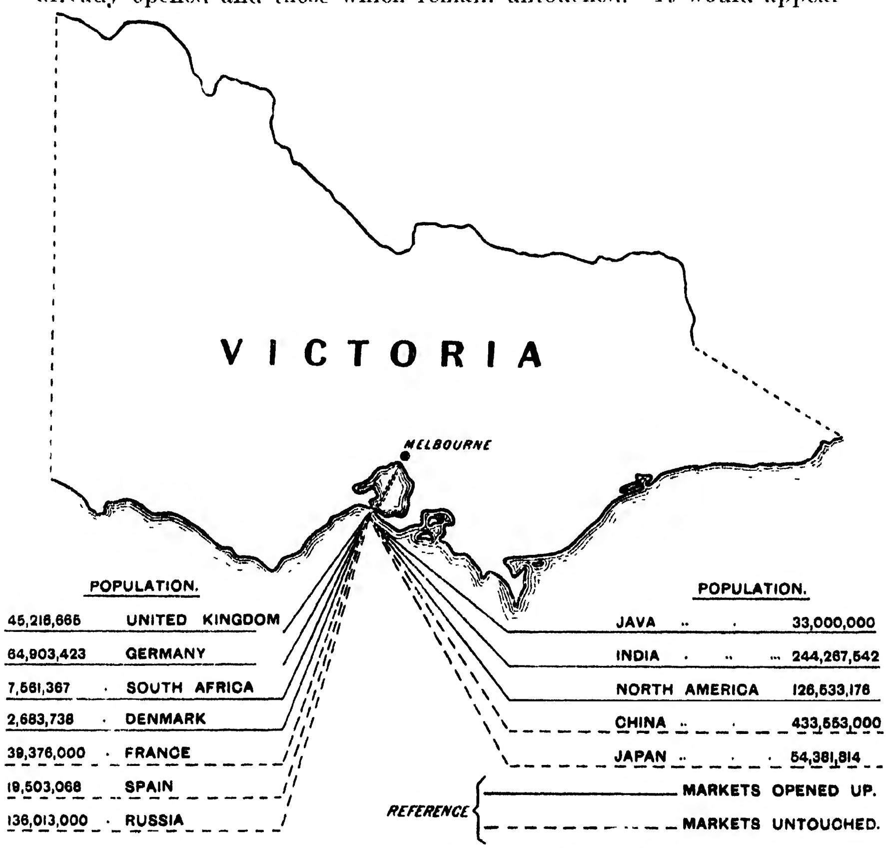


DIAGRAM SHOWING POSSIBILITIES OF OVERSEA MARKETS.

from the evidence of the figures which show the total quantities exported to the various countries since the trade was first established, that our export trade in fruit to oversea countries has practically not yet commenced in earnest, and that with better facilities for distribution coming into existence, the trade should, in the future, expand to an unlimited extent. As, however, proper facilities are not yet available for reaching many of the larger markets of the world, those interested in promoting the growth of the industry would do well to confine their attention to further developing the trade with those places which are the most accessible, and particularly with

the countries where trade has already, to some extent, become established. This is the opinion of many reputable and disinterested authorities whose interests and desires are in the direction of developing the industry as a whole, and on broad and sound lines. It is a well-known fact that our fruits are not distributed or disposed of to the best advantage in the markets of the United Kingdom, and that, as a consequence, the best prices possible are not always obtained. This want of proper distribution cannot, of course, be held altogether responsible for the unsatisfactory prices which are often realized. Improper methods of handling and putting up our fruits before shipment, and the neglect of correct and up-to-date transporation by land and sea, must bear their share.

The records taken from the Agent-General's reports for a number of seasons show that fruit has been carried during transit from Australia to the United Kingdom and Europe at temperatures much too high, and it has been already shown in the present series of articles that our methods of transportation by land are far from all that could be desired. The matter of improper distribution in the countries where our fruit trade has already been established is now under review.

In the *Journal of Agriculture*, November, 1911, the following were pointed out as the principal needs which were required for the oversea fruit export industry:—

(1) Provision for rapid cooling of fruit when picked.
(2) Cool car transport.
(3) Pre-cooling of all fruit prior to shipment.
(4) The installation of self-recording thermometers on fruit-carrying steamers.
(5) The provision of cool storage accommodation at London and other ports where transhipment is often required.
(6) Improved methods of consignment, sale, and distribution of fruits.
(7) The organization of the trade generally on the lines which have been adopted in California and Canada.

The matters indicated in (1), (2), (3), and (4) have already been mentioned in this series of articles, and (5) (6), and (7) will be dealt with in this and future articles.

Although the figures shown in the graph indicate that the larger percentage of our fruit trade, so far, has been confined to the United Kingdom and Germany, it might be inferred from these that the limit of supply to those countries had already been reached, and that we should, in consequence, turn our attention to markets still untouched. However, a knowledge of the facts indicate that instead of the limit of consumption of our fruits in the United Kingdom and Germany having been reached, our fruits are almost unknown to the greater proportion of the consumers in those countries.

DISTRIBUTING DISABILITIES.

So far, our fruits have been distributed from London and Liverpool only throughout the United Kingdom, and from Hamburg

throughout Germany. This is mainly caused through want of direct steam-ship service to other distributing centres in those countries, and as these centres can only be reached by transhipments, the exporters here have naturally been averse to attempting to open fresh markets by these means. They are justified in this attitude, as, without proper facilities for so doing, transhipment of consignments is usually a very unsatisfactory proposition. The goods are often delayed through hitches occurring at the port of transhipment, and, as the shipper, has no one to look after his interests, the fruit is, in many instances, subject to treatment such as to bring about serious deterioration in its market value, or perhaps render it quite unmarketable.

COOL STORAGE ACCOMMODATION IN LONDON.

Many good markets and distributing centres other than London and Liverpool exist in the United Kingdom, such as Hull, Bristol, Glasgow, Cardiff, Manchester, &c., but the difficulties of reaching these under present existing circumstances render a regular supply of fruit to these a risky proposition. There would appear to be one way only whereunder the difficulty of reaching these ports may be overcome, as, in the absence of a direct steam-ship service, London must, perforce, continue to be the chief distributing centre. This solution consists in providing suitable accommodation for holding shipments until such time as vessels trading with the centres mentioned arrive in London, and has been advocated for some years past in the columns of this journal. In the absence of such accommodation, our fruits, to reach centres other than London, must be distributed by rail to these centres or disposed of in London and distributed after sale. This obviously places the exporter at a great disadvantage, as it forces him into the position of having one market only in which to dispose of his goods. Were proper accommodation provided, his fruits could be held until these could be forwarded to centres other than London with a minimum of risk. The exporter would thus be in the position of placing his fruits in direct competition with the London markets, and would thereby stand a far better chance of securing enhanced prices than is possible under present conditions. Even so far as the London market itself is concerned, the establishment of proper cool storage accommodation would enable our exporters to regulate the supply and avoid gluts.

Summarized, the chief advantages which would accrue from cool storage accommodation in London would appear to be as follows:—

(1) The avoidance of gluts by possessing a means for regulating supplies.

(2) The facilities which would be afforded for distributing to centres other than London.

(3) Minimizing the possibility of our fruits being sacrificed through the operations of brokerage rings.

Extra charges would be incurred for carrying out such an arrangement, but it would probably so enhance the all-round market values that the benefits derived would more than compensate for the extra cost.

It may be that the cost of erecting and maintaining the accommodation indicated could not be borne by the fruit industry alone, and that such accommodation would require to be utilized for products other than fruit. This is a matter that could only be determined after consideration and thorough investigation of the facts. The suggestion that those interested in the Canadian fruit industry might reciprocate with those interested in this country seems a good business proposal, and one which should not be difficult to carry into effect.

(*To be continued.*)

CITRUS CULTURE IN VICTORIA.

(*Continued from page 382.*)

PART IV.—PRUNING.

By S. A. Cock, Orchard Supervisor, Bendigo.

Oranges, when received from the nursery, and after their roots have been washed of the mud puddle, will look as at Plate 18. Fig. 1 is a one-year-old tree with a branching head growth of too weak a character, and too high to start off as a three-armed tree; it is therefore cut back to a rod at *a*. If this head were allowed to remain, the new growths would not start readily from the terminals *b*. The strong new growth usually comes from lower down on the newly-planted tree, and renders it necessary, later on, to cut back the old growth to the new strong growth. A fair start is made by hard cutting. The growths come from every leaf axil, and are capable of being produced from every bud on the tree. Fig. 2, plate 18, represents a two-year-old tree with strong branches, well spaced, and branching at the proper height to form the head; this is pruned back to three or four buds on the three arms or branches as shown at *c*, pruning to outside buds.

Fig. 1, Plate 18, will form a new head, whilst Fig. 2, Plate 18, will go on increasing its arms immediately; therefore, it is preferable to obtain strong well-formed trees from the nurseryman, two-year-old for preference. By pinching the strong-growing trees this can be produced the first year as already explained. Nurserymen should see that the trees are headed at the proper height (15 inches from the ground), otherwise recourse to hard cutting to a rod is necessary, in order to form the head at the height stated. It is not necessary to allow any leaves to remain on the trees when planting pruning is done. Evaporation is great from the leaves, and the roots require all the nourishment possible to assure a healthy start. Plate 17 represents the trees after pruning, Fig. 1, the rod. Fig. 2 pruned to three arms. Should any central vertical strong growth be present, it should be absolutely removed. The idea at the outset is to space the branches, and whilst strong, almost upright, growths are required for a few years, the upright growths should be slightly to the horizontal, and no main upright central growth permitted. This is a fault often noticed with many growers, and is wrong, as will be shown later on.

Two strong growths occur every year, and two or more weakened growths. The strong growths produce the leading and strong lateral wood, whilst the weaker growths produce the smaller laterals. It is with the strong growths we are chiefly concerned—September to December, and February to April. It is not advisable to cut back again on orange trees after the planting pruning. The strong leading growths should be guided and led in the direction required. The objective for the first five years should be to procure a tree of sturdy upright growth, with strong uprights and strong laterals, both growths being well and equally spaced for the admission of sunlight and air, and the consequent assimilation and elaboration of fruit-producing wood. This is performed by treating the growths twice in the year—November and April. The terminal buds rest when growth ceases,

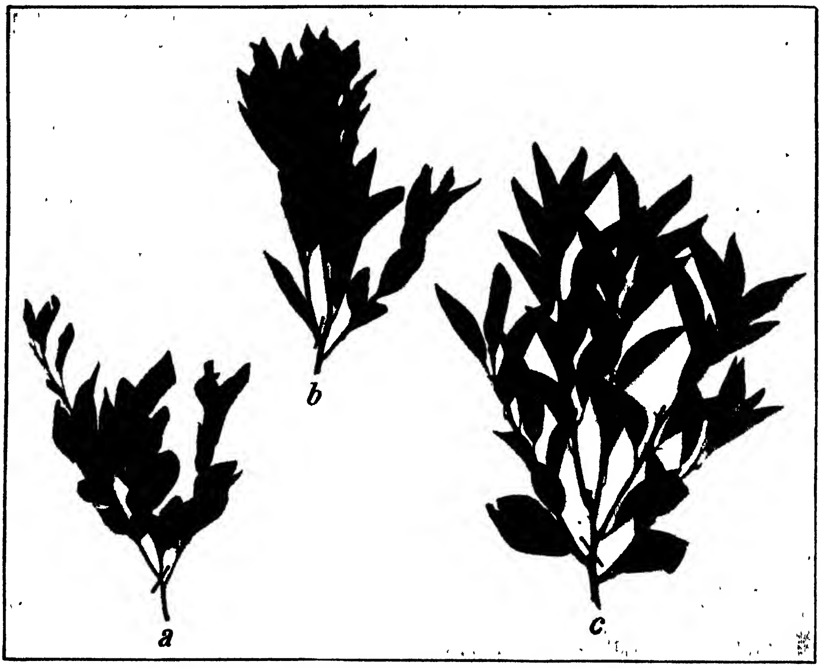


Plate 21.—Terminal growth before regulating

and the successive growths are depicted in Plate 21, *A, B, C.* The growth may be only single, but generally it is what is termed "clubbed," or many equal growths produced from nearly an equal base (leading buds close together). If all these buds are allowed to remain, they grow until eventually the stronger ones take the lead to form branches, and the weaker ones remain as stunted laterals. If these growths are not thinned the tree rapidly becomes a dense mass of foliage, excluding light and air, and producing no fruit in the centre of the tree, the centre being generally infested with scale. An orange tree in shape should be circular, and flat across the top, the diameter being equal to almost twice the height; or suppose every horizontal branch could be lifted erect, and bound together, they would be of equal height with any vertical branches. Plate 21

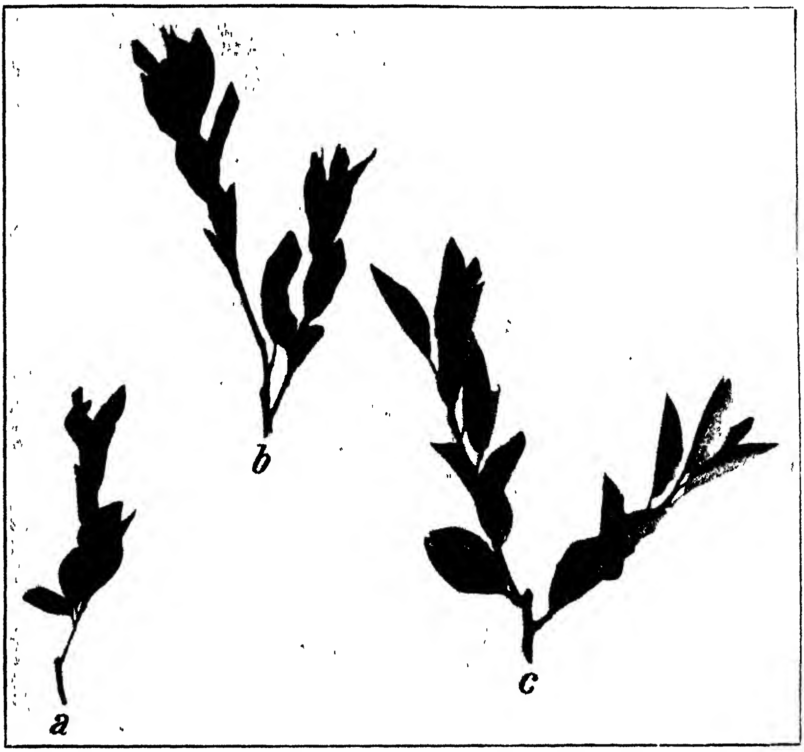


Plate 22.—Terminal growth after regulating.

Plate 23.—Washington Navel, 5 years old, Koondrook.

represents how these growths are regulated to bring about this result. At *a*, the growth is weak, and in order to make it strong and vertical, two growths are removed as shown at —; *b* is stronger than *a*, consequently two growths are left, the upright top growth to form a leader, and the bottom growth for a horizontal strong lateral. The weakened central growth, and the strong side growth are removed at — to strengthen the leader.

c is stronger than *b* or *a*, and as in deciduous fruit trees it is necessary to build a strong frame to support the lateral growths, so

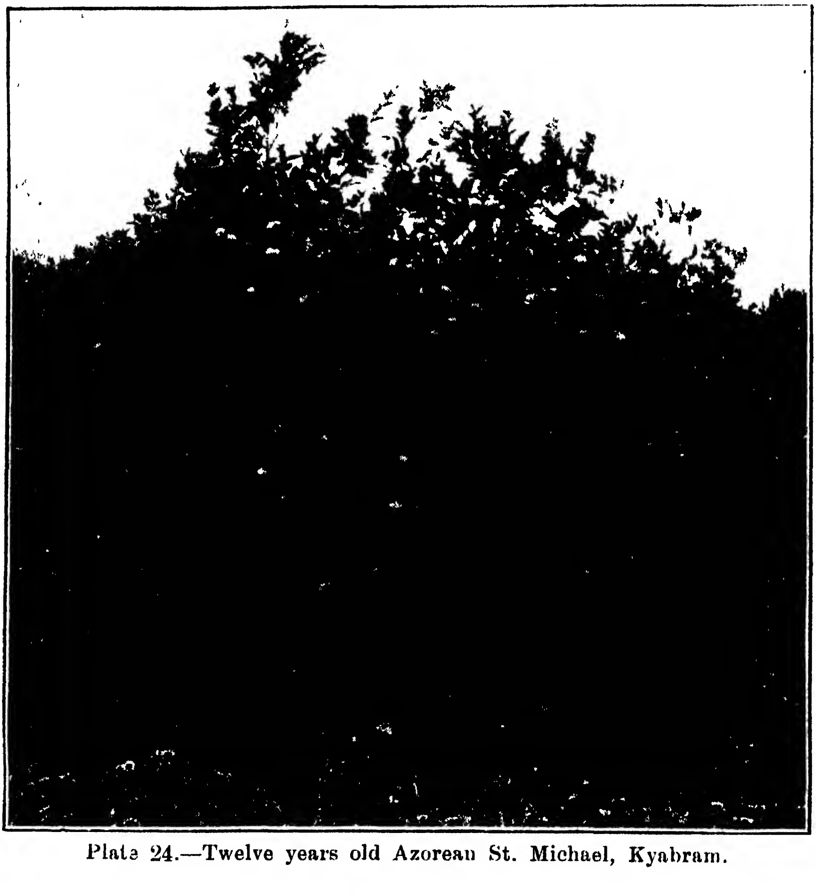


Plate 24.—Twelve years old Azorean St. Michael, Kyabram.

it is necessary in orange trees to induce strong leading growths to support the lengthy laterals in *c*. The leading growths in the centre are removed at —, and two growths of equal size and strength allowed to remain to increase the head or framework of the tree. This is a blocking process also, and while it regulates the leaders, it also places pressure on the buds below the regulated leaders, and pushes them into activity to produce fruiting lateral growths. Plate 22 represents *a*, *b*, *c*, with growths regulated. Plate 14 is a typical three-year-old tree. Plate 23 a typical five-year-old tree. Should any leaders show a tendency to grow stronger than the others,

and destroy the balance of the tree, they should be cut back to an outside bud, or absolutely removed by cutting back to a weaker vertical growth. At the age of five years, and when 8 feet high, attention should be paid to thinning out, also promoting a horizontal growth. Orange trees do not require to be hollow in the centre, but should be open enough for the admission of light and air on all parts of the tree as shown in Plate 24 (a twelve-year-old Azorean St. Michael), where the bearing surface is equally distributed right over and through the tree, not as is too often the case with untrained

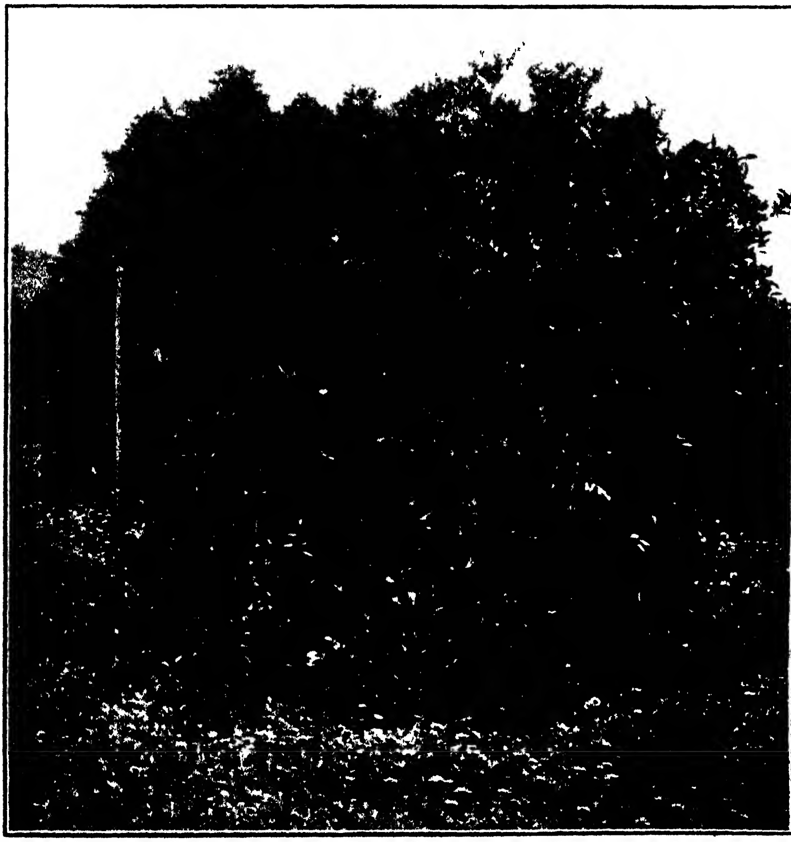


Plate 25.—Twelve years old Siletta, Kyabram.

trees, only over the outside surface, and within for a distance of a foot. Plate 25 represents a twelve-year-old Siletta orange, regulated and pruned flat across the top, height 10 feet, diameter 16 feet. Plate 26 shows a Washington navel twelve-year old, 10 feet high and 18 feet in diameter. These are good types of well-balanced trees, and have a much increased bearing surface as compared with dome-shaped trees; broad of base and falling away to a point on the top, this class of tree has usually been allowed to grow at will, and the strong central uprights have gained the ascendancy. The difference in bearing space is shown in Plate 27. Taking the outside circle

a—a—a to represent a dome-shaped tree, vertical section (trunk and branches not shown), 20 feet across at the base, and 12 feet high in the centre, the fruiting capacity would be as follows:—

1. When the fruit is borne everywhere along limb from centre to outside leafage—

In a space above double lines B—B of	$2095\frac{5}{21}$	cubic feet
In a space below double lines B—B of	$628\frac{4}{7}$	cubic feet
In a total space of	$2723\frac{17}{21}$	cubic feet

2. When fruit is borne only on the outer twelve inches of the tree—

In a space above double lines B—B of	$1527\frac{3}{7}$	cubic feet
In a space below double lines B—B of	$509\frac{1}{7}$	cubic feet

In a total space of $2036\frac{4}{7}$ cubic feet inside line marked C—C—C—thus there will be for fruit bearing a space of $2723\frac{17}{21}-2036\frac{4}{7}$, or $687\frac{5}{21}$ cubic feet.

If fruit is borne only on the outside surface A—A—A it has only a fruiting surface of $754\frac{3}{7}$ square feet.

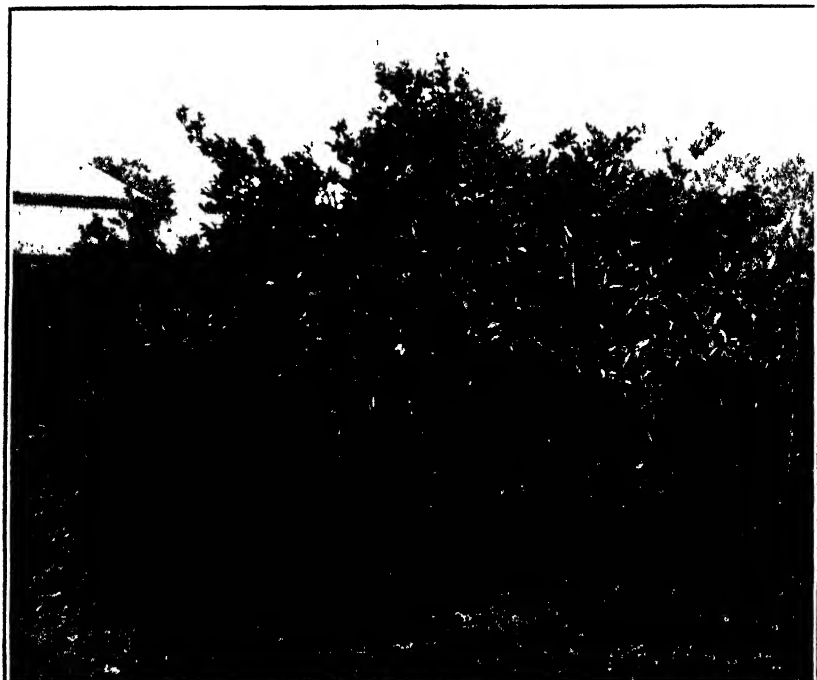


Plate 26.—Washington Navel, 12 years old

A tree as represented in Plate 25, is shown by the dotted lines in Plate 27. A—D—A—D—A has a bearing capacity in a space of $3{,}771\frac{3}{7}$ cubic feet from centre of tree to outside leafage, by properly regulating and pruning, and consequently admitting light and air. The fruiting zone of a tree should be right from the centre to the outside leafage, and, as will be seen from the foregoing calculations, a great amount of space is almost unproductive in many citrus trees.

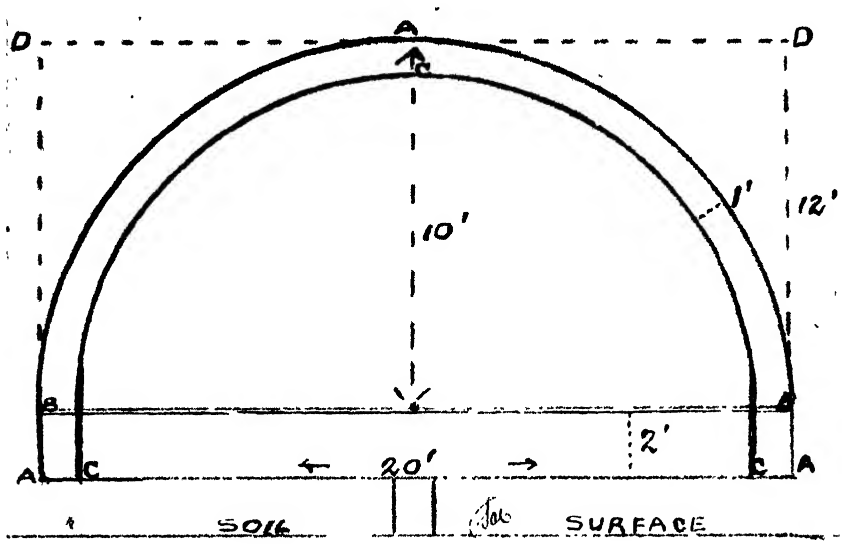


Plate 27.—Diagram of tree

Plate 28.—A. Flowering branch of orange.
B. Seville orange leaf
C. Fruiting branch of lemon.
D. Lemon leaf.

A flowering branch of the orange is shown at *A*, Plate 28. The fruit is borne on elaborated growths, either from the terminals, the axils of the leaves, or any bud brought into activity on the tree. *B* is the leaf of the common Seville orange, showing the winged petiole at *E*, and the articulation (point of union) at *F*. Fruit should always be cut off the tree, not pulled. Dead wood should always be pruned out, by cutting back to a healthy growth. Orange trees should not be pruned up, and the butt and surface feeding roots exposed to the sun. The bottom branches, if becoming too closely pressed to the ground by weight of overlying branches, may be shortened back, or removed, and room made for the overlying branches to take their place, and so relieve the crowding of the foliage of the tree. All strong sap growths (water shoots) should be removed as soon as detected; if allowed to remain, they use up a lot of the energy of the roots. In pruning citrus, always use a sharp cutting secateurs or knife.

(*To be continued.*)

EARTHWORMS IN VICTORIA.

By Janet W. Raff, M.Sc., Government Research Bursar in the Biological Laboratory, Melbourne University.

The important group of earthworms, the study of whose habits was made so fascinating by the researches of Darwin, has received considerable attention in Victoria and New South Wales, and numerous papers by Professor Spencer, of Melbourne, and Mr. J. J. Fletcher, of New South Wales, are to be found in the publications of the Royal Society of Victoria and of the Linnæan Society of New South Wales. These give chiefly specific descriptions and important points in the anatomy. They are specially interesting forms, but are by no means easy to classify. Other scientists in other parts of the world have also devoted much attention to our Australian species, this continent being one of the most abundantly stocked of any with these "diggers of the soil."

Previous to 1886, only three species of earthworms from Australia had been described, and a fourth from Tasmania: two of the three were from New South Wales, and the third was from Gippsland, Victoria. Since then large collections have been made from different parts of our State, and now the number of species described runs into hundreds. Some parts of the country are exceptionally favorable to their existence; for example, the south-eastern and south-western portions, and often more than one species may be turned over in a single clod of soil.

In spite of the work done on the external and internal structure, which is often somewhat complicated, no one has made a study of the habits of our Australian earthworms to such an extent as has Darwin of the European forms. In his book on *Vegetable Mould and Earthworms*, which deals with the "formation of vegetable mould through the action of worms, with observations on their habits," there

is an exhaustive description of the habits and effects on the soil of these small creatures, to whose agency the formation of vegetable mould on the surface of the earth is attributed. Although there are important points of difference structurally between our Australian worms and the European, their habits may be, generally speaking, considered similar. In New Zealand, Mr. A. T. Urquhart has carried out experiments on the worms of that island similar to those previously made by Darwin in England, and he has obtained results which, allowing for climatic differences, agree very closely with those obtained for the European species.

Earthworms are found in almost all parts of the world; in the tropics as well as in the temperate regions, although, naturally, they are more abundant in the latter, and, as has been stated above, they are unusually numerous in Australia. Although our continent has such a very rich earthworm fauna, in the settled districts we find our native forms are continually driven back and starved out by those introduced from Europe. This is noticeable also as regards other animals—for example, snails; and, consequently, to collect Australian species of these animals, one has to go out some distance from the settled districts. The European worms have been imported in soil and by other means, and it is the British species that are commonly

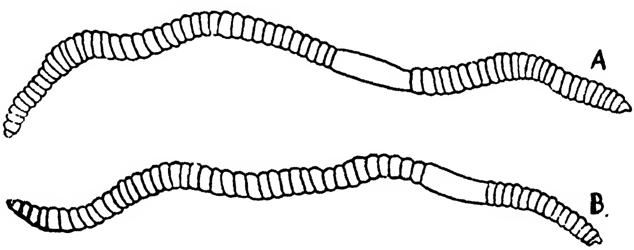


Fig. 1.

seen about our paths and gardens. The accompanying rough sketch (text-figure 1) shows the chief difference in appearance of our Australian forms as compared with those introduced. It will be noticed that the small portion of the body, which has a very smooth surface, and on which the segments are not clearly distinguishable, forms a girdle round the body of the worm; this girdle is much further away from the head end in the European species (A) than it is in the Australian (B). This is a ready means of distinguishing the two forms.

Earthworms have been called "ploughers of the field." They burrow through the earth, swallowing it, and absorbing as food any nutrient material contained therein; and their castings, continually brought to the surface, are blown about when dry, and thus spread over the surface of the ground as a fine layer of mould. An enormous effect is produced in this way on the superficial layers of the earth. Darwin calculated that there were in one small garden of an acre over 53,000 worms, and that 10 tons of soil per acre passed through their bodies annually. They were estimated to cover the surface with a layer of soil .2 of an inch in thickness, so some idea of the important part they play in nature may be formed. The soil is

submitted to the action of the atmosphere, and the burrows allow of the free percolation of rain into the deeper lying parts of the soil. The worms live chiefly in the superficial layers of the earth; this is passed through and through their bodies, and is ultimately carried to the surface as castings.

Spring and autumn appear to be the times in the year most favorable for casting, during and just after wet weather. At these times, also, worms are found frequently under logs and in situations that are kept moist. Their castings are not always visible on the surface of the soil, since they are sometimes deposited in their burrows. They form rugged masses, sometimes several inches high, of finely-divided particles of earth, and it has been shown that there is a greater bacterial fauna in the castings than in the surrounding soil. This is of interest, inasmuch as these bacteria are an important factor in the nitrification of the soil. Another part these worms play in nature, from an agricultural stand-point, is the rendering soluble of certain constituents of the soil that would otherwise be insoluble, or only dissolve very slowly. The soil particles, with various insoluble or difficultly soluble constituents, are passed through the body, and are subjected to the various fermentation juices in the body of the worm. This must render some of these more or less insoluble particles soluble and fit for the use of plants. The extent to which the soil is divided into particles must also have an important bearing on its fertility, because the finer the particles of any given quantity are, the greater will be their total surface area. This affects both the absorption by the roots of plants and the retention of water and soluble materials by the soil. The more finely-divided soil would hold a larger quantity of water when all the free water has been drained away, and it is also capable of retaining larger supplies of soluble plant food. Worms in some parts have been observed to drag leaves and other decaying matter into their burrows. This would tend to increase the water-holding power of the soil, and also to increase its fertility.

During the cold seasons the mouths of the burrows are often found protected by the castings, or, when no castings are being ejected, by heaps of little stones and pellets of earth. These probably both protect them from their enemies and aid in excluding the light. During dry periods the worms exist coiled up in little chambers at the bottom of their burrows. The burrows run down obliquely, with an occasional turn horizontally. Sometimes the surface portion of the burrow appears to be lined with a thin cement material, probably secreted by the worm and spread out by their gliding movements. The secretion, on drying, strengthens the walls and also affords a smooth surface over which the worm moves with ease, and is thus enabled to escape from enemies, such as centipedes and birds. The worm forms the burrows either by pushing the earth to one side, or by swallowing it as it moves along in a forward direction. Darwin has proved by means of experiments that the earth is swallowed both for the purpose of obtaining food and of making the burrows.

Before giving a brief account of the structure of earthworms, it might be of interest to note a few points on the habits of our large Gippsland worms—the so-called giant earthworms. One of these, *Megascolides australis*, has been fully described by Professor Spencer

in his monograph, published in 1888, in the *Transactions of the Royal Society of Victoria*, and is figured in McCoy's *Prodromus* (see Fig. 3). These giants commonly reach a length of 6 feet, and they may be ¾-inch in thickness. They live principally on the slopes of creeks or beneath fallen logs, and may be turned out of the ground by the plough. Owing to their great size it is not easy to draw them out from their burrows without injuring them. They appear to be able to expand the head and tail portions of their bodies, and so grip firmly to the soil, making it difficult to extricate them. The largest of these giants measured alive reached 7 feet 2 inches in length. There was some doubt as to whether these forms produced castings or not. Investigation showed that they frequently make their burrows in the holes of the so-called land crab, which animal builds up a large casting at the entrance to its hole; but, so far as was observed, when the worm's burrow was found away from the hole of the crab no castings were visible. From this it would appear that the worm itself produced no casting. Their burrows are very long and twisted, and the animal produces a peculiar gurgling noise as it moves about in them. This gurgling sound, which enables them to be located quite easily, is made by the body passing through the slimy fluid secreted along the sides of the burrow. It has been noticed, when the living animal is held in the hand, that the fluid has been thrown out in jets from small pores situated along the middle of the back. Professor Spencer notes that outside the burrow the worm is very sluggish indeed, and scarcely moves at all, but when in the burrow it is very rapid in its movements. The worms' cocoons are only rarely found in the burrows. These cocoons measure 1½ to 2 inches in length, and are formed by a secretion from the girdle-like portion of the body mentioned above. Each cocoon contains an embryo, is light yellow or brown in colour, and has in it a fluid similar to that secreted by the worm. It is made of a leathery material, and has a stalk-like process at both ends.

Although, as stated above, the work of worms is, in the main, of great beneficial importance, it must be admitted that at times their presence is of a rather disadvantageous nature. On lawns in England, for instance, in situations kept continually moist, the amount of casting is so great that the level of the lawns is very much damaged, and the worms become a great nuisance. In such cases, watering the lawn with lime water will quickly bring the worms out of their burrows, and will kill them. Care must be taken not to use excessive amounts of the lime water, since otherwise the grass may be browned. If the lime water is fully saturated, it is best diluted with water before use, particularly if the lawn is dry.

A few words on the structure of earthworms may not be out of place here. The body is cylindrical and ringed, that is, it is divided into a number of segments. There is no distinct head portion, but the front end shows a thick lip overhanging the mouth, while the hinder end terminates bluntly. There are no definite appendages, but most of the segments are provided with little bristles, or setæ, which help the worm in locomotion. These bristles may be felt by passing the worm through the fingers, and can be readily seen with

a lens. In the adult worm the saddle or girdle-like portion surrounding the body shows no segmentation externally, and is situated towards the front end of the body. The mouth is in the first segment underneath the thick lip, and the vent is in the last ring. The middle line of the back is distinguished by a clear red line, indicating the dorsal blood-vessel. If the animal is cut lengthwise along this line so as to expose the inside, it will be seen that the constrictions between the rings on the outside of the body correspond to partitions, dividing the worm into segments. The organs of the body are clearly visible passing through these partitions on their way from the front to the hinder end of the body. The food canal stands out as a tube filled with earthy material. The accompanying diagram (text figure 2) represents the front portion only of a worm that has been cut in this manner, and it will be seen that the food canal in this region is somewhat complicated, although beyond this it is a simple tube. The mouth (*B.C.*) is surrounded by fleshy lips (*C.T.*) and passes on through the throat (*PH.*) to the crop (*C.R.*); this in turn leads on to the gizzard (*GIZ.*), which is very strong and muscular, and in

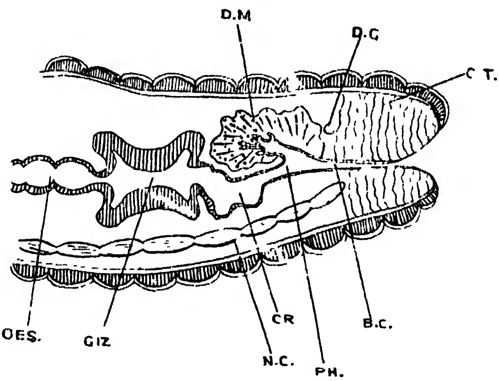


Fig. 2

which most of the "chewing" of the earthy material takes place; this is followed by the intestine, a comparatively simple tube which continues to the end of the body. Digestion of the food takes place for the most part in the front portion of the canal. The blood of the earthworm is contained in a definite system of vessels running from the front to the hinder end, both above and below the food canal. At intervals these long vessels are connected to one another by smaller lateral branches encircling the digestive tube. The blood is coloured red, and is distributed all through the skin by a network of small vessels. There are no special breathing organs in the worm, aeration of the blood being mainly carried on through the skin. The nervous system consists of a small mass of "brain" tissue (*D.G.*) situated at the extreme front end of the body, above the food canal. This so-called brain is connected to a nerve chain (*N.C.*) that runs along the length of the body below the digestive tube. It can be distinguished as a thin whitish line near the lower surface of the body. A pair of tiny nerves passes off from this main chain in each segment of the body.

The earthworm has no eyes, but is very sensitive to light, which falls on its front segments. It is also sensitive to vibrations, although possessing no organs of hearing. There are no known organs of taste or smell; but the worm can "apparently distinguish red from green cabbage, and exhibits a decided preference for certain foods, such as carrot, celery, onion, and horse-radish."

It is of special interest to remember that the group of worms is the lowest and simplest collection of forms showing any difference between a front and a hinder end. Although there is as yet little external sign of cephalization, that is, of differentiation into a head region, still, the earthworm has a "brain," *i.e.*, a central nerve mass in this head region.

The distribution of earthworms is of particular importance as indicating past changes in the contour of the larger land masses of the earth's surface. Since the earthworm is killed by salt water, it is evident that it could only migrate, previous to man's intervention, along land connexions. The fact that we find allied and very

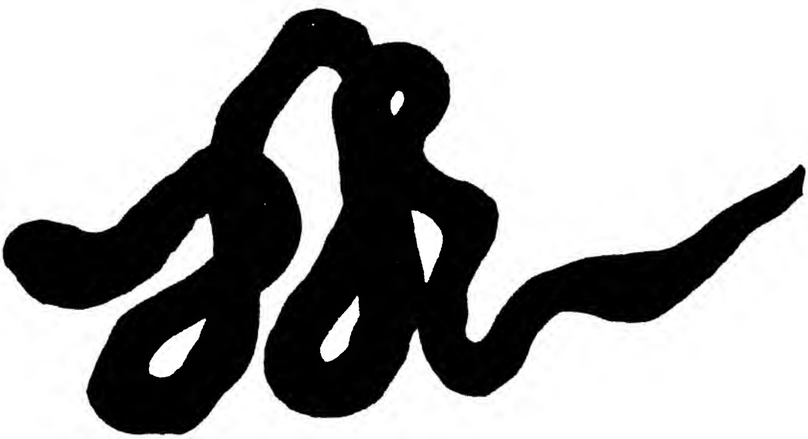


Fig. 3.- Giant earthworm (from McCoy's Prodromus).

specialized forms in the three Southern Continents and in certain islands around the Antarctic region undoubtedly points to the former land connexion of all these areas.

In conclusion, I would like to quote a few words on the distribution of our *larger* worms from the important monograph mentioned above. Considering the presence of closely-allied forms in South Africa, and in the southern parts of India and Ceylon, as well as in the south of Australia, Professor Spencer says of the earthworms that "the same laws which governed the distribution of other animals must also have governed theirs; and it is just possible that these great earthworms may be the lingering relics of a once widely-spread race of larger earthworms whose representatives at the present day are only found, as occurs with other forms of life, in the southern parts of the large land masses of the earth's surface. Possibly, careful search will reveal the existence of a large earthworm in the southern parts of South America."

FARM SANITATION.

(*Continued from page* 311.)

By C. H. Wright, Instructor in Plumbing, Swinburne Technical College, Hawthorn.

PART 3.—SEPTIC TANKS AND SEWERAGE CONNECTIONS.

As already mentioned, the discharge from a water-closet should not enter a drain through a disconnecting trap—only in exceptional circumstances.

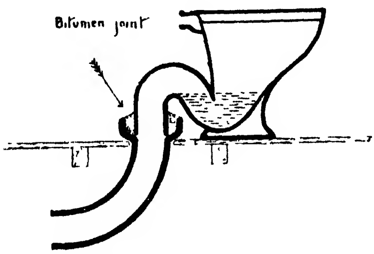


Fig. 24.—Showing method of connecting a pan to a drain pipe.

Fig. 24 shows the method of connecting a pan and trap to a drain in a detached outbuilding for servants' use. If the closet is built of woodwork, the stumps, soleplate, and plinths should be of red gum or jarrah, the closet must be made rigid and not be attached to fences or clothes posts. As the pan and trap are screwed to the floor, any settlement or shifting of the building is likely to cause a fracture.

Bathrooms often provide suitable accommodation for a water-closet. Whatever apartment is selected, it is important that one of its sides at least shall be an external wall. See that the door does not open directly into a living room.

A water-closet apartment should only be entered from a well lighted and well ventilated hall, passage, lobby, or staircase. The apartment should be provided with a window opening directly into the external air.

See that there are no vent holes in the ceiling whereby the air from this apartment may be conveyed through the ceiling to other parts of the house.

In addition to a window, the room should be provided with independent means of constant inlet and outlet ventilation by means of air bricks built in the external walls.

A spring should be fixed to the door of this room to insure that it always remains closed.

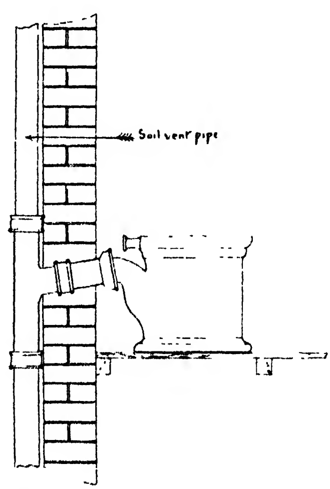


Fig. 25.—All water-closets inside a main building should be vented by a soil vent pipe.

All water-closets inside a main building should be vented by a soil vent pipe, as shown in Fig. 25.

Where the branch from the closet to the soil vent pipe is more than 3 feet in length, or where there is more than one closet, special provision should be made to prevent syphonage by back venting, as shown in Fig. 26.

Every closet pan should be furnished with a reliable flushing cistern of at least three gallons capacity. The cistern should be fixed at a height not less than 5 ft. 9 in. from the floor to the top of the cistern.

BATHROOM FIXTURES.

For the sake of cleanliness, appearance, and convenience, select fixtures that will enable the sweeper to get the brush behind; go in for open plumbing work.

Select a bath with a rolled edge and metal shower screen, a pedestal water-closet with a movable seat to enable it to be used as a slop hopper.

Have a lavatory basin supported on iron brackets with the waste and other pipes exposed, not closed in with boards to form a cupboard and hide from view any leakage from pipes or accumulation of rubbish that has a habit of collecting in such places.

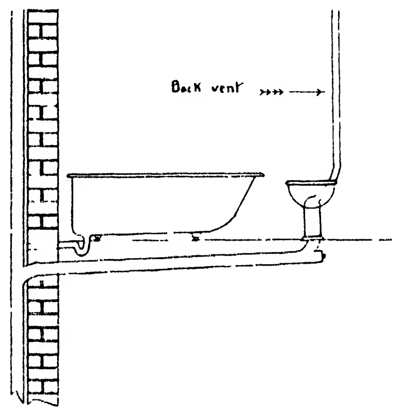
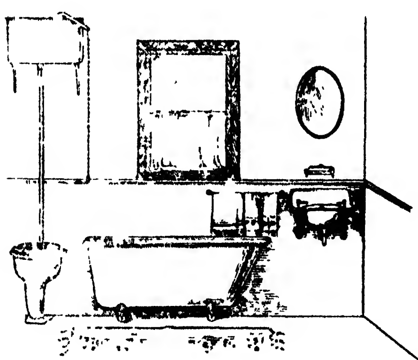


Fig. 26.—When a closet is more than 3 feet away from the soil vent pipe, it should be back vented to prevent syphonage of the closet trap.

HEIGHT OF VENTILATING PIPES TO DRAINS.

As before mentioned, there will always be a circulation of fresh air passing through a well-planned drainage system, the higher the educt vent above the induct vent, the better will be the circulation.

It is of the utmost importance that the position of the educt vent should receive careful consideration. The following suggestions will help as a guide.



Bathroom fixtures.

A main drain should always be vented at its upper end, the mouth of the vent pipe sh uld be at least 6 feet higher than any window, door, or other opening, within a distance of 30 feet. In any case it should be carried 2 feet above the highest point of the roof ridging.

Branch drains need not be vented if they do not exceed 15 feet in length.

Educt vents should be of 4 inches diameter and extended upwards as above, the induct vent if standing in open space more than 30 feet from windows and other openings need not extend higher than 9 feet.

When a sufficiently strong support cannot be obtained for the induct vent pipe, a plated and strutted 4-in. x 4-in. red-gum or jarrah post, sunk 2 feet in the ground, should be fixed to support it.

Remember it will always be easy to find contractors willing to instal sewerage connexions with less than the necessary number of vent pipes, separate wastes, &c., cheaply, especially where there is no Sewerage Board Inspector to satisfy. In country districts householders are an authority unto themselves, for upon them rests the responsibility of selecting a designer and contractor capable of installing proper and safe sanitary conveniences.

SEPTIC TANKS.

Septic tanks can be built in sizes ranging according to the sewage output of the homes they are to cope with.

The tank itself receives its flow at one end and discharges at the other, and no matter what the extent of its work may be, it usually has a capacity of 24 hours' sewage flow. Tanks are usually built in concrete or brickwork.

All sewage contains, within itself, necessary bacteria for its own purifications, but before sewage can be thoroughly purified by a biological process, it must undergo two changes. The solid organic matters must be split up and liquefied into simple forms, and the whole must be oxidized. The sewage must be dealt with first by anaerobic, and secondly by aerobic bacteria. And it has been proved that these organisms will quickly grow and multiply, and rapidly liquefy the solid matters, changing them into harmless forms.

As before mentioned, these organisms are classified into anaerobic, those whose work is performed in the absence of free oxygen, and aerobic those that grow or thrive only in the presence of oxygen.

The anaerobic treatment of sewage, which produces the liquefication of the solids, preferably takes place in a tank constructed in such a manner, that the velocity of the sewage on entering it is so reduced that the solids are deposited, and that the organisms can thrive in it, and liquefy the organic matters during its progress through the tank. Thus, for this to be efficiently performed, a tank should be large enough to hold 24 hours' supply of crude sewage.

When sewage has undergone anaerobic treatment for the specified time, it will be almost wholly without oxygen, that gas having been converted into carbonic acid gas by the decomposing organic matter, produced by the mixed organisms, which arrive in the sewage.

Sewage that has been passed through a properly-designed liquefying tank is so free from organic matter that if it is subsequently dealt with by aeration only, it rapidly becomes clear and free from smell.

The results of experiments go to show that the maximum purification is obtained in warm climates in much less time than in cold. For while a 24 hours' contact may be required in some parts of Australia, an eight hours' contact may be sufficient in the tropics.

Temperature has a marked effect on the amount of gas generated in the septic tank.

A septic tank at first acts as an ordinary settling tank. A proportion of the slowly-settling particles are carried over in the effluent, the remainder, together with the more freely-depositing

particles, are, by the flow of the liquid, carried a variable distance along the tank before they become arrested on the bottom, where they form a layer of sludge. To this each succeeding volume adds its portion. In this way a rising floor of sludge is gradually formed, *which diminishes the liquid capacity*, and necessarily increases the rapidity of the flow of the liquid through the tank. In consequence, more and more of the suspended matters find their way out of the tank until the effluent becomes too foul. The tank operation has to be stopped, the accumulation has to be removed, and the tank cleaned out.

As before mentioned, septic tanks usually have a capacity of 24 hours' sewage flow. A tank of less size either becomes rapidly choked, and allows an amount of suspended matter to go forward in the effluent.

The first object in the septic tank is to reduce the flow of sewage, so that all solid matter may be deposited as quickly as possible. The position and construction of baffle walls is, therefore, a matter of considerable importance.

In small installations, the great difficulty is always the uncertain flow of sewage. It is, therefore, desirable to make a septic tank for small installations sufficiently large to counteract this difficulty.

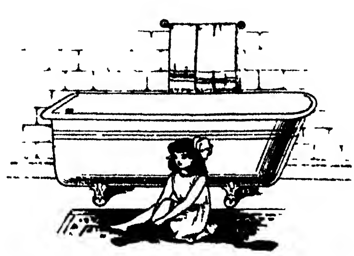
When it is necessary to clean out a septic tank care should be taken to always leave a small amount of deposit in the bottom for the immediate renewal of the liquefying action when the tank is put into operation again.

The bacteria will no doubt develop in an absolutely clean tank, but it will take time for them to accumulate to the quantity required for the maximum degree of purification.

It is important that a regular and systematic withdrawal of sludge be adopted, in order that the working efficiency of a bacterial tank can be maintained. If withdrawn in a haphazard way, allowing the operation to proceed until the tank is full, or the effluent foul, it cannot be regarded as satisfactory.

The withdrawal of sludge necessitates some method of sludge disposal. A reliable method is to convey it to trenches in the land, which are covered over as soon as the sludge will bear the weight of earth. In this way the nuisance from exposure of sludge is reduced to a minimum, and the danger which might otherwise follow from the drying and powdered sludge finding its way into the atmosphere is avoided.

(*To be continued.*)



WHEAT AND ITS CULTIVATION.

ESSENTIAL FACTORS IN SUCCESSFUL WHEAT CULTIVATION.

No. XIII.

(*Continued from page* 205.)

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

A considerable amount of attention has been given in previous articles to the structure, nutrition, composition of the wheat plant; the various methods of cultivation, seeding, manuring, and crop rotation found to be effective in our wheat areas, and the improvements that may be effected in the prolificacy of the wheat plant by systematic selection and cross-breeding. It may now be fitting to summarize the most important factors which make for success in the cultivation of wheat.

In considering such a summary, it is necessary to bear in mind, as has already been pointed out, that by far the greater portion of the wheat area in Victoria lies north of the Dividing Range, and in regions of relatively low rainfall. The average annual rainfall of the area in question varies from 10 inches to 20 inches. The following may be taken as the approximate average annual rainfall of the three great wheat districts of the State:—

Mallee ..	.. From 10 to 14 inches.
Wimmera ..	.. From 14 to 17½ inches.
Northern ..	.. From 14 to 21 inches.

The greater portion of this rain falls from April to October, and the late spring and summer are invariably hot and dry.

These districts produce over 85 per cent. of the wheat of Victoria.

FIRST FACTOR—EARLY FALLOWING.

One of the most essential factors in the raising of heavy wheat crops under these conditions is to fallow and fallow well. The whole trend of scientific teaching and practical experience is dead against the continuous cropping of wheat on the same land.

It is a matter of common observation that well-fallowed land in our wheat districts will grow bushels more wheat per acre than land that has been merely stubble ploughed. Experiments in the drier parts of the wheat belt and practical experience have both conclusively demonstrated that more wheat can be grown over a period of years on a given block of land by cropping it every other year than by growing wheat continuously on the same land every year. In these days of costly labour it is becoming more and more necessary to carry out a thoroughly efficient system of cropping. It does not now pay under Victorian conditions to raise small crops. The most profitable system of agriculture under existing economic conditions in the wheat belt is to raise the largest crops possible on such parts of the farm as are reserved for grain. The way to do this is to raise such grain crops less frequently, fallow, and *alternate* the growing of *forage* crops for

feeding down with sheep and lambs with the cultivation of wheat. This is the keynote of successful wheat-farming in these areas.

It is often stated that the continual practice of bare-fallowing deprives the soil of organic matter—the soil's most valuable constituent—and, therefore, it may be supposed that bare-fallowing will gradually impoverish the land. This objection has already been considered (*vide* Journal, page 336, June, 1912), and, all that need be said here is, that if the land is impoverished, the fault lies not with the practice of bare-fallowing, but in growing too many grain crops, and carting them off the farm instead of growing them in rotation with forage crops and pasture for feeding down on the farm with sheep and lambs.

With the adoption of judicious rotation there need be no fear that the practice of fallowing will ultimately result in soil depletion. On the other hand, the alternation of wheat and bare-fallow *without* the intervention of forage crops or pasture is the straight road to soil exhaustion.

The advantages of the practice of bare-fallowing have already been set out in detail (pp. 331-336, *Journal* for June, 1912). The fundamental principle underlying the practice is that it conserves soil moisture—the limiting factor for successful agriculture in an arid country, and it enables a considerable portion of the rainfall of one year to be conserved in the soil through the summer, and thus to augment the supplies which fall subsequent to the sowing of the crop.

In order to illustrate this, the results of one of a number of investigations made during the past summer on fallowed and non-fallowed land may be quoted.

At Longerenong, on April 1st, 1913, the average moisture content of a block of fallowed land taken 4 feet deep amounted to 32.72 per cent., whilst that of a non-fallowed block 10 yards distant was 26.12 per cent. a difference of 6.6 per cent. of the total weight of soil (*vide* Appendix A). This, translated into familiar terms, means that the fallowed soil had an amount of moisture over and above that of the non-fallowed block equivalent to 4.07 inches of rain. That is to say, the crop sown on the fallowed land will be able to draw on 4.07 inches more moisture than the crop grown on non-fallowed land. The water requirements of crops grown under Australian conditions have not yet been determined. An exhaustive investigation to test this point is in progress at the Central Research Farm, Werribee, and the Rutherglen Experiment Farm.

Under American conditions King* finds that 7½ inches of water over one acre sufficient for the requirements of at least a 30-bushel crop of wheat provided *all* the moisture is utilized by the crop. Assuming these figures to hold here, the extra amount of moisture conserved in the soil at Longerenong on the fallowed block is sufficient to produce 16.28 bushels of wheat more than the crop that could be raised on the non-fallowed block.

If fallowing only resulted in the conservation of soil moisture it would be sufficient to justify its practice in an arid district.

* King—*Irrigation and Drainage*, p. 97.

There are other incidental advantages accruing from the practice. Chemical and bacterial activities are greatly stimulated through the summer months by the moisture conserved in the soil. The drying out of the soil results in the cessation of all bacterial life. The commingling of air and moisture, consequent on summer tillage operations, and the high soil temperatures in Northern Victoria, enable bacterial and chemical activity in the soil to proceed at a rate unknown in the humid countries of the world.

As a result, a considerable portion of the dormant plant food is gradually liberated, and made available for the succeeding wheat crop. Not the least important of these activities are those due to the nitrifying organisms (*vide Journal*, September, 1912, p. 545). And these may be taken by way of illustration. In order to present some tangible evidence of their activity in a well-fallowed soil, let us see how much nitrate was produced as a result of their energy at Longerenong last season.

On 1st March, 1912, there were present in the first 4 feet of the fallowed block 141.82 lbs. of nitrate-nitrogen per acre, whilst the non-fallowed land, 10 yards distant, was found to contain only 47.74 lbs. Assuming that nitrate of soda contains 15 per cent. of nitrogen, it follows that there was formed as a result of bacterial activity an amount of nitrate in the fallowed soil equal to 632 lbs. of nitrate of soda per acre. If a farmer wanted to purchase this nitrate he would require to pay £4 10s. for it. Other important plant foods are made available through the practice of fallowing.

Other advantages are that by bare-fallowing the work of the farm may be distributed evenly throughout the year, and this enables the farmer to have large areas of land in the highest state of tilth ready for sowing in the autumn.

NOW IS THE TIME TO FALLOW.

When it is realized that the main object of fallowing is to conserve moisture, it will be obvious that the sooner fallowing is commenced the more moisture can be conserved, and the better the ultimate prospects of success.

Now is the time to fallow, and now is the time to lay the foundations for a heavy wheat crop in 1914. The seeding will have been finished in the wheat areas by June, and during July and August the ploughs should be in full swing and the bulk of the fallowing overtaken.

It has been repeatedly demonstrated that land fallowed early gives in normal years heavier crops than land fallowed late, whilst in dry seasons the crop grown on early fallowed land is worth bushels per acre more than that raised on land fallowed late.

So impressed are some farmers with the benefits of early fallowing that many now run over the stubbles in February and March with a disc, and plough immediately after seeding. The early discing assists in conserving moisture, allows the autumn rains to readily penetrate the soil, facilitates subsequent ploughing operations, and promotes the early germination of the weeds.

In fallowing in winter, give a good stiff furrow, the depth depending on the nature of the soil and its previous treatment.

Generally speaking, the earlier-ploughed land may be allowed to remain in the rough till the latter end of August, when it should be worked down with the scarifier. In the case of land ploughed in spring, it is advisable to follow close on the ploughs with either harrows or cultivator, so as to lose as little moisture as possible. From spring-time until seed-time the grower will need to jealously guard the conserved stores of soil moisture. Evaporation will be reduced to a minimum by keeping the surface loosely mulched to a depth of 3 inches by scarifying as often as is necessary. The necessity for scarifying arises, whenever, owing to summer rains, the loose surface mulch is in danger of consolidation and compaction.

SECOND FACTOR.—THOROUGH CULTIVATION.

The peculiarities of the climate of our wheat areas are such as to make thorough tillage a prime factor for successful cropping.

The most casual of observers cannot fail to notice each season the most marked contrasts between the crops of various growers in belts of apparently identical country. While these differences may often be accounted for by the quality of the soil, it more frequently happens that they are due to better cultivation.

The raising of successful crops in regions of relatively low rainfall requires, above all things, thorough tillage.

It should be borne in mind that any year may be a dry year, and, therefore, such methods should be followed as will insure a successful crop if the rainfall is below the average. The same methods which will secure a favorable crop in a dry year will also secure highly profitable crops in favorable seasons.

The importance of early fallowing has already been discussed. But early fallowing is of little use if the land is not properly cultivated through the summer.

Reference to Appendix A—dealing with the amount of moisture conserved by fallowing—will show that a *neglected* fallow is little better than autumn-ploughed land. The main purpose of fallowing is missed if the summer cultivation is withheld. The successful wheat-growers in the very dry belts of South Australia, where the rainfall is frequently less than 10 inches per annum, know from long experience that the thorough cultivation of early fallowed land is the only way to secure a payable crop in a dry season. In these areas the cultivators may be seen at work throughout the summer months. Thorough cultivation is equally necessary in more humid areas, but for somewhat different reasons. There is an old saying that "tillage is the best manure." It is well known that in most agricultural soils there are enough mineral plant foods to supply the needs of heavy crops for hundreds, if not thousands, of years. Why then should we require to apply manures? Because by far the greater part of the plant food is locked up in the form of insoluble mineral combinations. It is well that this is so, otherwise these constituents might have been leached out of the soil long ago. Now, the real source of a soil's fertility must be looked for in the vast stores of plant food lying dormant in the soil, and tillage and thorough cultivation are the means by which this plant food is made available for the use of crops. Jethro Tull recognised this fact over 150 years ago, and founded his *Horseshoeing Husbandry* on it.

The soil contains enormous reserves of dormant plant food, and our aim should be to render as much of this available by thorough cultivation as possible. The more thoroughly the soil is tilled the more available plant food will be formed, and the less will be the manure bill. It is in this sense that "thorough tillage is a substitute for manure."

In the case of the wheat plant, other results accrue from good tillage which make for successful crops. Every experienced wheat-farmer knows how important it is to have a firm, finely-divided, consolidated seed-bed for the wheat crop. This consolidation of the seed-bed cannot be secured in a week or a month. Time is a necessary factor for the process, and the consolidation is effected by the packing action of the rain, and the frequent stirring of the soil. Such a seed-bed, resting on a moisture-laden subsoil, is in the very best condition not only for resisting droughty spells, but also for yielding heavy crops. The advantage of a fine firm seed-bed in a dry season is specially pronounced. The finely-divided soil particles act like an unbroken series of force pumps on the storage reservoir below, and keep the roots rapidly and constantly supplied with moisture.

On the other hand, in a loose, open, cloddy seed-bed, the stores of soil moisture cannot rise freely and rapidly by capillarity, and in times of stress the crop will give out. Such a seed-bed is the invariable result of hasty preparation of the soil.

The writer has, during the past seeding, observed in various parts of the State thousands of acres of crop sown straight on the sod of newly-ploughed stubble land.

The patchy germination of these crops, the spindly early growth, and the lack of that deep vigorous green characteristic of young wheat when sown on well-fallowed land, do not augur well for heavy yields.

The best preparation for a wheat crop in districts with a limited annual rainfall, the bulk of which falls between April and October, is to fallow early, fallow well, keep the soil well cultivated through the summer, and be ready to concentrate the whole strength of the farm on the drills and cultivators when the first favorable autumnal rains fall.

THIRD FACTOR.—SYSTEMATIC ROTATION.

Continuous cropping of wheat on the same land year after year, and the biennial system of wheat and bare-fallow alternately have been shown to be undesirable, and to fall short of the requirements of a permanent system of agriculture, inasmuch as these practices lead to the depletion of the organic matter of the soil, and consequently, its fertility.

The outstanding weakness of our system of wheat culture is that insufficient provision is made for the restoration of the organic matter of the soil. It is known that the losses of organic matter due to fallowing in an arid climate are very considerable. The functions of importance of organic matter have already been dealt with, and all that need be said here is that the value of a soil for agricultural purposes depends in no small measure on its organic content. Deprive

the soil of its organic matter and you have rock dust, and what farmer would care to farm a soil made of freshly-pulverized bricks!

The absence of organic matter makes a soil sterile, its presence in quantity is a guarantee of fertility. It greatly increases the water-holding capacity of a soil, vastly improves the texture and mechanical condition, and is the material round which all biological activities in the soil are centred.

The most material problem ahead of the agriculturists of this State is to evolve systems of cropping which will give the maximum yields possible under existing climatic conditions, and at the same time maintain, and even increase, the soil's fertility.

The productivity of virgin land as compared with land cropped with cereals for several generations is a matter of common observation. The difference in the fertility is almost solely due to the depletion of organic matter. Were it due to the loss of mineral matter we could immediately restore the soil to its pristine fertility by the application of a sufficiency of artificial fertilizers.

There are only three ways in which organic matter of the soil may be increased:—

(1) The application of stable or farmyard manure.
(2) Ploughing in of green manures.
(3) Pasturing and feeding down of forage crops with stock.

The first is impracticable on a wheat farm in Victoria under *existing* economic conditions.

The second method is very largely practised in orchards and vineyards with admirable results, but it has not yet been used by the Victorian wheat-farmer on a large scale, though such a practice is very common in arid wheat areas in other parts of the world.

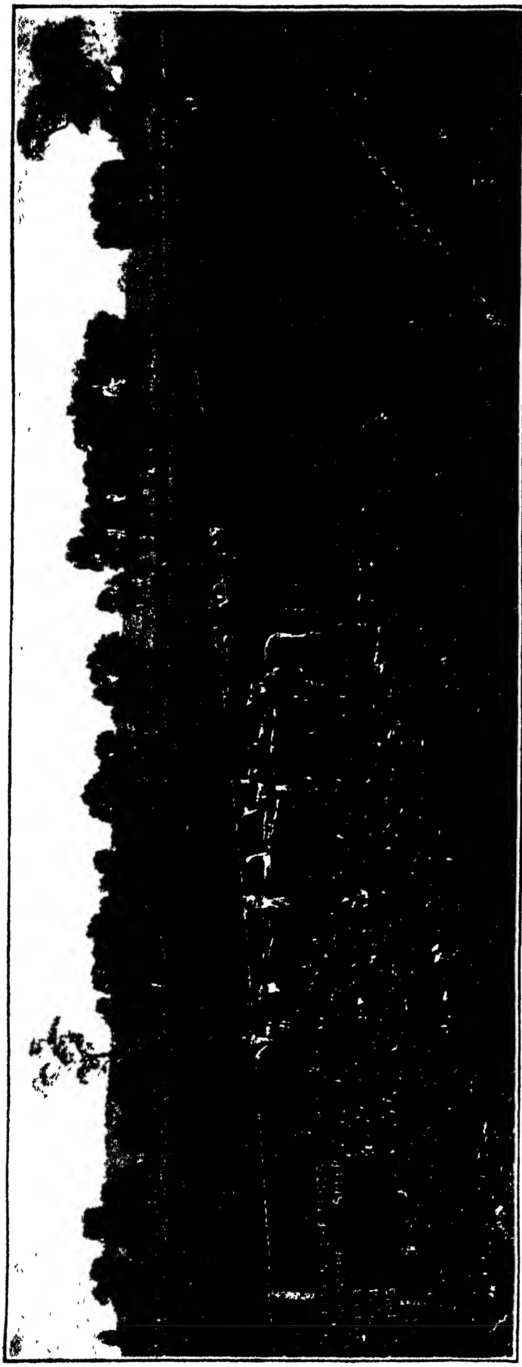
The results of the green manurial experiments in progress at the Werribee and Rutherglen Experiment Farms will be of interest in this connexion, and demonstrate the value of this practice in wheat-growing.

The introduction of pasture into the rotation is now very common in Victoria. Every wheat-farmer should keep sheep, and either grow wool or raise fat lambs. For this purpose a considerable area of the farm is required for pasture. Under these circumstances, the commonest rotations practised are, wheat, pasture, bare-fallow; and wheat, oats, pasture, bare-fallow.

These rotations require a minimum of labour, and are well adapted for districts in which holdings are large, land is relatively cheap, and the rainfall is scanty. They fit in well with existing economic conditions in our drier wheat areas, and especially on mixed farms where sheep are kept in numbers.

It is very questionable whether in these rotations the gain in organic matter is equivalent to the depletion during the period of fallowing and cropping. In most districts, the grass and herbage which springs up spontaneously from the wheat stubbles is of very little grazing value, especially if the land is properly fallowed, for the object aimed at in fallowing is to suppress all weeds, and to allow the wheat crop to have undisputed possession of the soil.

That this fact is recognised is seen by the practice followed in the Wimmera, where, instead of relying on this adventitious herbage springing from the wheat stubbles, a crop like Algerian oats is disced



GENERAL VIEW OF THE FEEDING-OFF EXPERIMENTS, RUTHERGLEN EXPERIMENTAL FARM.

in on the stubbles in March and April to produce grazing for sheep.

In the more favored districts, however, something more than one crop in three or four years is possible. Here peas, rye and vetches, rape, mustard, kale, and mixed forages can be grown successfully in addition to cereal crops, and in these cases wheat should be grown in alternation with forage crops for feeding down on the land with stock. Wherever these forage crops are grown in regular rotation with wheat the maintenance of fertility can be assured.

A green crop contains 95 per cent. of its total solid matter from the carbonic acid gas of the air, and only 5 per cent. from the soil. When a green crop is fed to stock the greater portion of the organic matter, and a considerable proportion of the contained mineral matter is returned to the soil. Thus, by the feeding down of green crops with stock, the organic content of the soil is greatly increased, for the organic matter returned in the animal excrements was obtained by the crop from the air.

The total amount of green forage produced is usually many times *greater* than the total amount of herbage and grass which springs up on

the uncultivated wheat stubbles, and for this reason the fertility of the soil will be far more rapidly improved under a system of feeding down of forage crops than under ordinary pasturing.

Some idea of the grazing value of such forage crops as compared with the value of ordinary pasture may be seen from the results of some feeding-off tests, conducted at the Rutherglen Experiment Farm last season, and given in Table I. In considering the figures, it is necessary to bear in mind that the season was most unfavorable for forage crops. These figures are only put forward tentatively, and it is proposed to continue the investigation for a number of years before any conclusions are drawn.

TABLE I.

FEEDING-OFF TESTS.

No and Plot	No. of sheep on plot.	Weight of sheep on plot	Weight of sheep off plot	Increased live weight of sheep per plot	Days on plot	Weight of green feed per acre.			Increase of live weight of sheep per acre.
		lb.	lb.	lb.		tons	cwt.	lbs.	lb.
1. Rape	19	1,381	1,742	361	21	8	18	104	722
2. Rye and Vetches	19	1,363	1,603	240	21	5	10	6	480
3. Pease	25	2,451	2,607	156	14	6	10	96	312
4. Barley	19	1,326	1,635	309	25	7	10	80	658
	5'	480	500	20	14				
5. Beerseem	10	1,001	1,100	105	14	1	11	6	210
6. Natural Pasture, 1 cwt. super.	10	731	782	51	12		..		102
7 Natural Pasture, unmanured	10	735	770	35	12		..		70

* First Feed. † Second Feed.

Seven plots of half-acre each were marked out and fenced, and five were sown in May with rape, rye and vetches, peas, barley, and beerseem respectively. These were compared with two plots of natural pasture, one of which received a dressing of 1 cwt. of super.

The sheep used were uniform in grade, and weighed on and off each plot. The increase in live weight and the grazing value of the various plots were thus obtained. In the case of rape, rye and vetches, peas and barley, the grazing value of the crop was at least three to four times that of the natural pasture. Had wheat stubbles been chosen instead of natural pasture the differences in the grazing value would have been still greater.

Not only is it possible to extract higher returns per acre by the growing of forage crops instead of relying on the pasture following the wheat stubbles, but the organic content of the soil is increased, and what is more important, the yield of wheat grown in such a rotation will be raised. Good wheat land in the more favored districts of the State should be capable of growing more than one crop in three or four years. If it cannot do so, then the outlook is not encouraging for our increasing population. The growing of special forage crops for feeding down with stock seems to indicate the direction in which our rotation systems may be improved.

FOURTH FACTOR—RATIONAL MANURING.

The guiding principle in the application of manures is to use them as a *supplement* to the natural soil resources, and not as a main source of fertility. Most good agricultural soils have vast stores of dormant plant food, and our aim should be to develop as much as possible of this plant food lying latent in the soil by thorough cultivation, and supplement any deficiencies with fertilizers.

What these deficiencies are can best be found out by actual experiment, and having determined these deficiencies, the problem for each farmer is to find out the most profitable and economic way of supplying the soil's needs.

Speaking generally, the most marked deficiencies of Victorian wheat soils are organic matter and phosphoric acid. The problem of restoring organic matter was considered in the previous section.

So far as phosphates are concerned, numerous experiments and practical experience have demonstrated beyond doubt that the most profitable method of application is in the form of superphosphate. It gives the best results in normal seasons when the seed and manure are drilled in together at seed-time. If scarified in, some weeks or months before seeding, heavier applications will be required to produce the same effect as when sown with the seed. The amount to be used with greatest profit depends on the rainfall and the nature of the soil. In districts of very light rainfall, as little as 30 to 40 lbs. per acre are used. In moister districts, and especially on limestone soils, much heavier dressings may be applied. Heavy dressings may be used with profit on soils rich in lime. Dressings ranging from 1 to 2 cwt. per acre are regularly used on many limestone soils in South Australia, and such heavy dressings have a most stimulating effect on the quality of the subsequent pasture.

It may be interesting to note that the average amount of superphosphate used per acre during 1911 in the wheat districts of Victoria was as follows:—

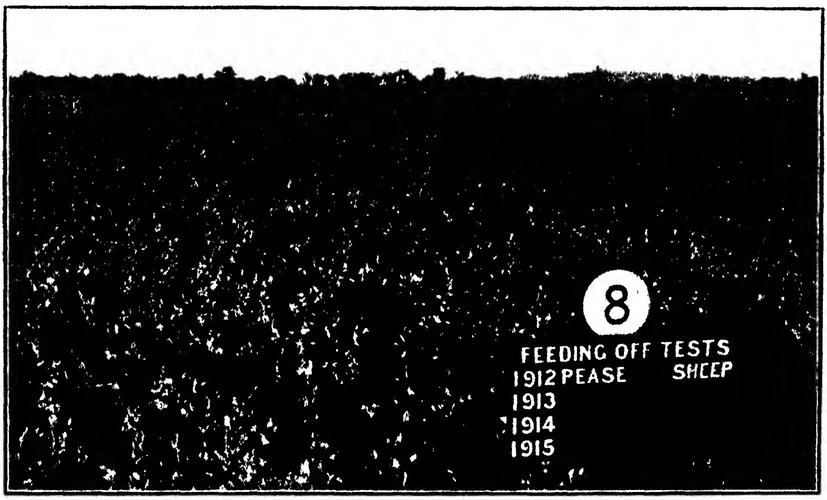
Mallee	47 lbs.
Wimmera	59 lbs.
Northern	61 lbs.
North-East	71 lbs.
Western District	95 lbs.

Continuous applications of superphosphate will not, as is often supposed. "exhaust" the land. It will merely bring about a state of affairs in which an excess of phosphates is present, and the soil will not then respond to further applications of phosphate. In all districts with a light rainfall, superphosphate is likely to continue the most profitable of all phosphatic manures. In the wetter areas, and more especially on soils deficient in lime, basic slag, or Thomas phosphates, is a valuable manure. It has a particularly stimulating effect on the pastures. A practice often followed is to sow a citrate soluble phosphate like basic slag on the fallows during the summer cultivation, and to supplement this by a small dressing of superphosphate at seed-time.

Bonedust and ground rock phosphate have given negative results in experimental trials. Both are very insoluble, and, in the drier areas, are of very little value for securing immediate results.

Many of the phosphatic guanos on the market are insoluble, and only very slowly made available in the soil and are consequently little better in their action than bonedust or ground rock phosphate. There are other phosphatic guanos, however, which are very finely divided, and which contain a considerable proportion of citrate soluble phosphate. These are similar in their action to Thomas phosphate.

Nitrogenous manures have very little effect on the wheat crop on areas north of the Dividing Range. Owing to the high soil temperatures during the summer months, the moisture conserved in the fallows, and the comparative absence of summer rains, combined with the frequent aeration of the soil as a result of frequent summer tillage, nitrification proceeds at an exceedingly rapid rate in our northern soils, and to this must be ascribed the non-necessity for nitrogenous manures.*



CLOSER VIEW OF THE FEEDING-OFF EXPERIMENTS, RUTHERGLEN EXPERIMENTAL FARM.

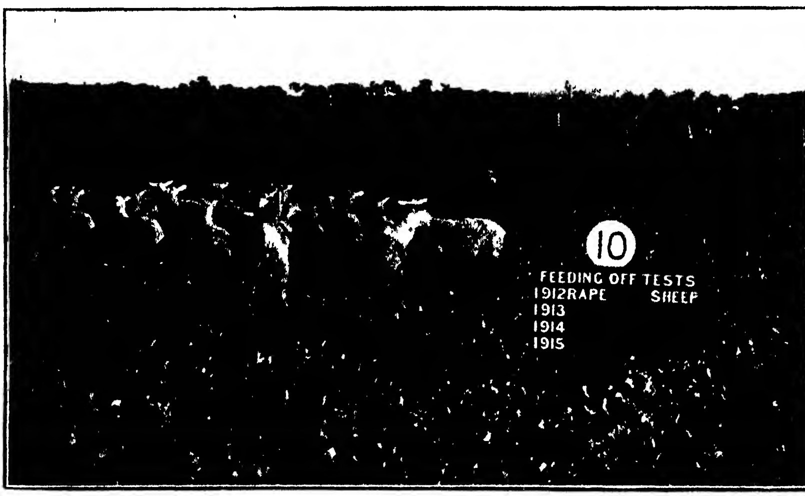
In the wetter Southern and Western Districts the same climatic advantages as regards nitrate production in the soils do not hold, and here the need for nitrogenous manures has become apparent. The needs of the north and south in this respect have been made subjects of separate inquiry by this Department. Experiments conducted in 1902 and following years showed that the addition of sulphate of ammonia gave an increase of only 3 lbs. of wheat per acre on an average of 94 farms, and in no single case of the twelve local groups into which the 94 farms were divided did the nitrogenous manure repay the cost of its purchase. In the moister southern districts, the need for soluble nitrogenous manures was apparent, for on an average of 50 farms tested, 1 cwt. of nitrate of soda increased the yield of hay by nearly 6 cwt., and 1 cwt. sulphate of ammonia by exactly 8 cwt.

* *Vide* Appendix "B" for fuller details.

We may say, therefore, that in the drier districts the use of nitrogenous manures does not seem to be called for, and they may even prove harmful. In the wetter districts a limited call for nitrates at present exists, and this may be expected to develop as cultivation becomes of older date.

Potassic manures have not been found of much value in the wheat areas; mainly, it would appear, because of the high potash content of the majority of the soils.

Lime occupies a peculiar position. There are whole districts in which the lime content of the soil is considerable, and applications of lime must, therefore, be considered unnecessary. This is notably the case with the Mallee and Wimmera. On the other hand, south of the Ranges, the Goulburn Valley, and the north-east, the soils are generally deficient in lime. On these latter, an application of lime should prove profitable. Experiments conducted at Rutherglen last season indicate that good results might be expected to follow the application of lime in the north-east.



FEEDING-OFF OF RAPE PLOT WITH SHEEP.

The following yields were recorded on the Permanent Experimental Field, Rutherglen, with Zealand blue wheat:—

No manure	11.4 bushels per acre.
Superphosphate, 1 cwt.	16 bushels per acre.
Superphosphate 1 cwt., 5 cwt. lime ..	17 bushels 24 lbs. per acre.
Superphosphate, 1 cwt., 10 cwt. lime ..	18 bushels 20 lbs. per acre.
Superphosphate, 1 cwt., 20 cwt. lime ..	20 bushels 16 lbs. per acre.

While the extra returns obtained are not sufficient to pay for the cost of application, it is probable that the benefit will be distributed over a number of years, and that the liming will thus ultimately prove profitable. It may be added that the season was very unfavorable, as practically no rain fell from January to the middle of June. The effect of the liming will be better seen when these plots again come under crop. The need for lime varies with the district, and careful experimental work is necessary to determine the most profitable form, rate, time, and mode of application.

FIFTH FACTOR—SYSTEMATIC SEED-SELECTION.

A great advance will be made in our wheat industry when the importance of selection of seed is fully appreciated. The improvements in our system of wheat-growing during the past decade have had reference mainly to the improvement of the plant's environment. Very little attention, however, has been given to the improvement of the plant itself.

In order to get the best results from early-fallowed, carefully-worked, properly-rotated, rationally-manured land, the seed sown should be the best the farmer can secure.

The first requirement is to secure varieties suited to the climatic and soil conditions. Of the large variety of wheats at the command of the farmer only relatively few are suited to his conditions. In the dry, hot districts, early maturing wheats possessing a minimum of flag, and a maximum of grain are required. Steinwedel, King's Early, Gluyas, Cumberland, and Federation are examples of such wheats. In moister districts, later maturing wheats like Yandilla King, Marshall's No. 3, Genoa, and Dart's Imperial will generally be found more profitable.

But the important practical point is, that once the farmer has secured varieties known to be of value under his conditions, he should set to work like a breeder of stock, and get the very best possible out of the chosen variety. This can only be done by rigorous systematic selection. This practice has already been discussed in detail.*

It may be confidently stated that such selection will increase the cropping capacity of any given variety at least 15 to 20 per cent., and will render quite unnecessary the periodical "changing of seed" and counteract any tendency to degeneration in our ordinary wheat varieties. Everybody is familiar with the value of selection when applied to the evolution of laying strains of White Leghorns, and to the improvement in the milking capacity of a dairy herd.

Equally effective results can be secured in raising the prolificacy of our wheat varieties.

The results obtained by selection on oats, barley, and potatoes have already been shown.† So far as wheat is concerned, at Longerenong, last season, seed of Federation selected on lines laid down in article IX. gave 43.2 bushels per acre, whilst ordinary Federation seed, sown alongside, under identical conditions, gave 34.5 bushels. The value of this increased yield, at 3s. 4d. per bushel, was equal to 29s. 2d. per acre. Similar results can be obtained by any farmer who chooses to take the care and attention necessary for the process.

Thorough grading of the seed is also vitally necessary on every wheat farm. Grading of seed with a good machine not only removes weed seeds, grains of other cereals, rubbish, damaged and cracked grain, and thus separates material of considerable commercial value for feed, but of negligible value for seed, but the graded residue is more prolific than the ungraded product.

For the trifling expenditure of 6d. per bushel, graded seed may be obtained which will yield 10 to 15 per cent. more wheat per acre

* *Vide* Wheat Improvement, *Journal of Agriculture* (Victoria), Jan. 1913, pp. 38–56.
† *Vide* Wheat Improvement, *Journal of Agriculture* (Victoria), Jan. 1913, p. 51.

than ungraded seed. This fact has been demonstrated repeatedly by various experiment stations, and is confirmed by results obtained last season at the Wyuna Experiment Farm. Thus, grain from the harvester was separated by the grader into three distinct grades, two of which gave increased returns of 2 bushels 39 lbs. and 2 bushels 26 lbs. per acre. An equivalent of 8s. 10d. and 8s. 1d. per acre respectively, and a low-grade sample which would normally be reserved for feeding purposes.‡

APPENDIX "A."

THE AMOUNT OF MOISTURE CONSERVED BY FALLOWING.

An investigation was commenced at Longerenong last season to determine the variation in the moisture content and the nitrate content of soils when fallowed, cropped, and pastured. For this purpose two even strips of land were selected in May; one of these had been lying in fallow, and the other was down in pasture. The fallowed portion was subsequently sown with wheat. Soil samples of the fallowed, and pasture plots to a depth of 5 feet were taken on 1st June, and on analysis were found to contain the following amounts of moisture:—

TABLE I.

PERCENTAGE OF MOISTURE IN FALLOWED AND PASTURE LAND. LONGERENONG.

	Fallowed. Per cent (on dry soil)	Non-fallowed. Per cent (on dry soil)
0-12 inches ..	29.57 ..	18.99
12-24 inches ..	36.02 ..	23.40
24-36 inches ..	29.41 ..	24.87
36-48 inches ..	33.21 ..	29.00
48-60 inches ..	35.93 ..	32.08
Average first 5 feet ..	32.8 per cent.	25.6 per cent.

The soil samples were taken in the following manner:—A trench, the width of the spade, and 5 feet 6 inches deep, was sunk on each plot. One narrow edge of the trench was plumbed off, and a spit of soil 1 foot deep and 2 inches thick was quickly removed to a smooth board, and after being thoroughly mixed, was transferred to a hermetically-sealed jar. Various soil samplers were tried, but owing to the sticky nature of the soil the slower method of sinking trenches was adopted.

During the first week in September the cropped plot was divided into three portions; on one of these the crop was permitted to grow, the remaining two portions were ploughed and cultivated. One of these plots, "the neglected fallow" plot, received no further cultivation. The other plot was cultivated as often as the fallow land in the vicinity was worked. Two months later soil samples on the "worked fallow," "neglected fallow," "cropped land," and "pasture land"

‡ Treatment of Seed Wheat, *Journal of Agriculture*, April, 1913.

were taken to a depth of 4 feet. The following table summarizes the results:—

TABLE II.

AMOUNT OF MOISTURE IN LAND VARIOUSLY TREATED, 1ST NOVEMBER, 1912—LONGERENONG.

—	Worked Fallow	Neglected Fallow	Cropped Land.	Pasture Land.
	per cent.	per cent.	per cent.	per cent.
0–12 inches .	24·83	17·46	19·21	24 31
12–24 ,, ..	27 05	24 88	24 72	27 91
24–36 ,, .	30·24	27 88	31·00	26·31
36–48 ,, ..	34·74	31 46	33·82	29·47
Average first 4 feet .	29·21	25 42	26 69	27·00

The process of soil sampling was repeated each month until 1st April, 1913.

The following table summarizes the results:—

TABLE III.

SEASONAL VARIATION OF THE MOISTURE CONTENT IN SOILS VARIOUSLY CULTIVATED (LONGERENONG, 1912-13).

(Average of 4 feet.)

—	Plot 1—Worked Fallow	Plot 2—Neglected Fallow.	Plot 3—Cropped Soil	Plot 4—Pasture Land
	per cent.	per cent.	per cent.	per cent.
June, 1912	32·8	32·8	32·8	25·6
November, 1912	29·21	25·42	26·69	27·0
December, 1912 .	31·89	27 27	25·44	29·22
January, 1913 .	30·45	27 89	22·96	26·49
February, 1913 .	33·96	25 01	22·41	22·57
March, 1913 ..	32·58	20 61	27·14	25·00
April, 1913 ..	32·71	27·16	26·70	26·12

It is apparent, from these figures, that the moisture content varies widely from month to month. The reason for the variation is twofold—the unequal amounts of evaporation from the four plots, and the additions to the soil content in the form of rain. The former depress the moisture content, whilst the latter augment it. Table IV states the monthly rainfall at Longerenong from June, 1912, to March, 1913, inclusive. It will be seen that the rainfall was very unequally distributed over the months under review.

TABLE IV.

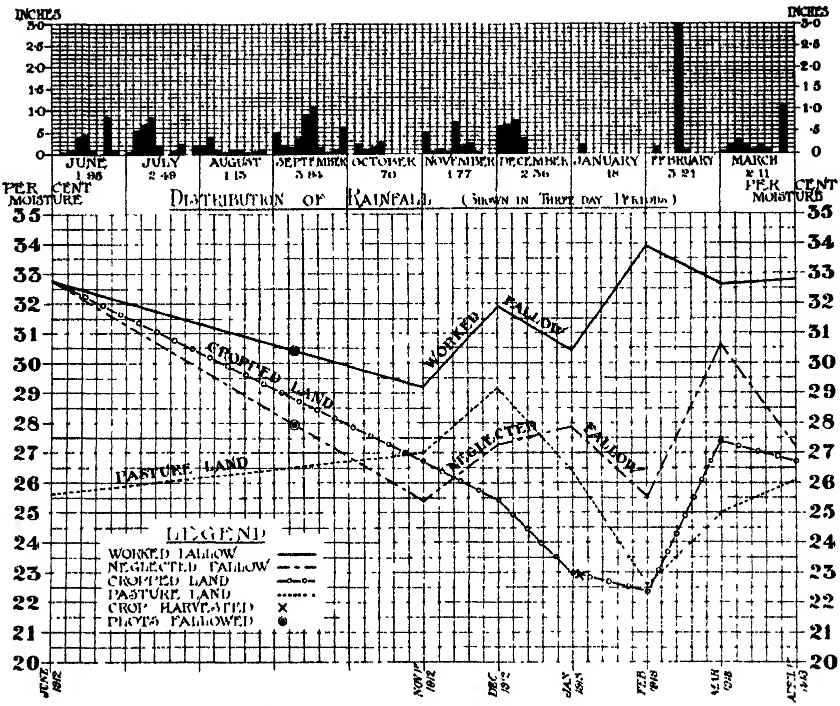
RAINFALL AT LONGERENONG, 1ST JUNE—30TH APRIL.

June	1.95	December	2.36
July	2.49	January	0.18
August	1.13	February	3.21
September	3.94	March	2.11
October	.70	April	.87
November	1.77		

The variations in the four plots may be more clearly followed by showing the results graphically, and considering them in relation to the rainfall.

TABLE V.

GRAPHS SHOWING THE DISTRIBUTION OF THE RAINFALL IN THREE-DAY PERIODS, AND THE VARIATION IN THE AVERAGE MOISTURE CONTENT OF LAND VARIOUSLY CULTIVATED.



VARIATIONS IN MOISTURE CONTENT OF SOILS (LONGERENONG)

AVERAGES OF FIRST FOUR FEET

From these graphs it will be seen that the fallowed plots had in June, 1912, an average moisture content of 32.8, whilst the pasture land contained only 25.6 per cent. On 1st November, the variations in moisture content of the four plots were marked, but the differences were smaller than at any subsequent period. The worked fallow plot contained 2.21 per cent. more moisture than the pasture plot, and 3.79 per cent. more than the neglected fallow, which at this time had a hard crusty top. From this point the differences in the plots increase until 6th February, when they reached the maximum. The moisture in the cropped plot gradually fell from 32.8 per cent. to 22.41 per cent. when the crop was harvested. The heavy rainfall in February gave a marked increase of moisture content to all plots save the "worked fallow." Investigation showed, however, that on this plot the excess moisture had penetrated below 4 feet.

At the end of the period under review the moisture content of the fallowed land averaged 32.71 per cent., practically the same as it was

ten months previously, whilst the "neglected fallow" plot, and the "pasture plot," were 27.16 per cent. and 26.7 per cent. respectively.

In other words, the fallowed plot contained on 1st April, in the first 4 feet of soil, an amount of water over and above that of the neglected fallow plot, equal to 5.55 per cent. of the *total weight* of the soil.

Expressing these figures in terms of moisture content, it means that if the amount of moisture in the neglected fallow be reckoned at 100, the amount contained in the cultivated fallow would be 120.6, *i.e.*, the cultivated fallow land contains 20.6 per cent. more water than the neglected fallow.

We may express these figures in another way. The cultivated fallow contains an extra amount of water over and above that of the neglected fallow equivalent to 5.55 per cent. of the total weight of the soil, and an amount over and above that of pasture land of 5.59 per cent. of the total weight of the soil.

Reckoning the weight of 1 acre-inch of water at 101 tons, this extra water conserved by the fallowed plot as compared with the pasture plot is equivalent to 4.14 inches of rain. The cultivated fallow has also conserved an amount of extra water equivalent to 3.43 inches of rain, as compared with the neglected fallow.

APPENDIX "B."

VARIATIONS IN NITRATE NITROGEN IN LAND VARIOUSLY TREATED.

The soil samples from the four plots already described were analyzed for nitrate nitrogen. The following table gives a summary of the nitrate content of the first 4 feet of representative soil from each plot during the period, June, 1912—April, 1913:—

The analyses were conducted by Messrs. P. R. Scott (Chemist for Agriculture) and W. C. Robertson (Supervising Analyst).

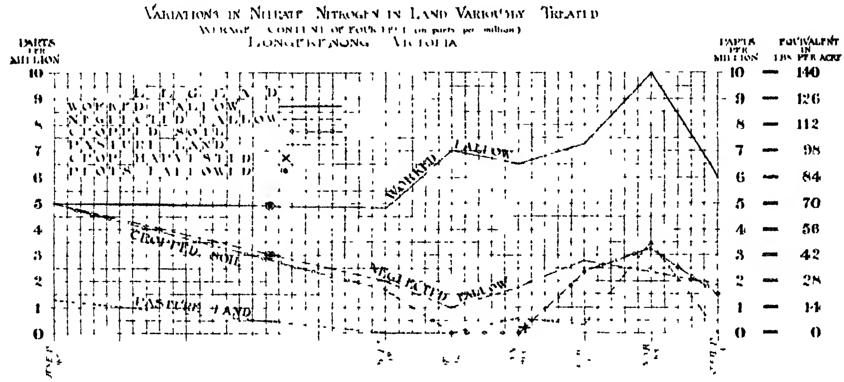
TABLE VI.

SHOWING NITRATE-NITROGEN IN SOILS VARIOUSLY TREATED (AVERAGE OF 4 FEET).

(In parts per million.)

Month.	Plot 1—Worked Fallow.	Plot 2—Neglected Fallow.	Plot 3—Cropped Land.	Plot 4—Pasture Land.
June, 1912 ..	5·13	5·13	5·13	1·21
November, 1912 ..	4·96	2·01	1·91	Nil.
December, 1912 ..	7·09	1·10	Trace	Nil.
January, 1913 ..	6·54	1·76	Trace	·67
February, 1913 ..	7·3	2·74	2·36	·41
March, 1913 ..	10·13	2·27	3·27	3·41
April, 1913 ..	5.85	1·81	1·43	Trace

The results will be clearer if they are reduced to graphical form, and the nitrate content is calculated to an equivalent of lbs. per acre of soil 4 feet deep. The following graph gives such results:—



These results may be summarized thus:—

(1) On a plot which was kept well fallowed through the summer there was a maximum both of moisture and nitrate-nitrogen throughout the period. In the first 4 feet of soil on this plot the maximum amount of nitrate was found in March, when no less than 141.9 lbs. per acre were present, = 10.13 parts per million. Further, the greater part of the nitrate found at any one period was invariably confined to the surface layers. Thus, the vertical distribution of this nitrate-nitrogen on 1st March was as follows:—

0–12 inches	..	24·07	parts per million		=	84·2	lbs. per acre	
12–24 ,,	..	8·66	,,	,,	=	30·3	,,	,,
34–36 ,,	..	4·40	,,	,,	=	15·4	,,	,,
36–46 ,,	..	3·40	,,	,,	=	12·0	,,	,,
Average Content	..	10·13	,,	,,	=	141·9	,,	,,

At the beginning of April, the amount of nitrate on this plot was 81.9 lbs. per acre, nearly three times as much as that found in any of the other three plots.

(2) In a "neglected fallow" both the moisture content and the nitrate content are very much lower than in a well-worked fallow. So far as the nitrogen content is concerned, it would appear as if a hard, crusty fallow contained about the same amount of nitrate as stubble land in the late autumn.

(3) The nitrate content of the cropped plot gradually declined till December, when it reached zero. It remained depleted of nitrate-nitrogen until the crop was removed (January), when it gradually improved.

In January, the surface foot of soil contained only 12.70 per cent. of moisture, and a mere trace of nitrate. The February rains (3.21″) brought the moisture content of the surface foot up to 28.69 per cent., and the average nitrate content to 3.27 parts per million, after which it steadily declined to 1.43 parts per million, an equivalent of 20 lbs. per acre.

(4) The pasture plot showed the widest variation. It gradually declined from 1.21 parts per million to zero. From November to December the nitrate content was at a minimum, after which the amount steadily rose till on the 1st March it reached 3.47 parts per million. On 1st April only a trace of nitrate was found.

Incidentally these results throw much light on the question of fertilization of our wheat crops in the arid areas. So long as bare fallowing is practised, it would appear that nitrogenous manures are unnecessary. The bare-fallow plot contained throughout the year far more available nitrogen than is required to satisfy the needs of the heaviest wheat crop that could be grown on a 20-inch rainfall. It would appear that, although our soils are not so well supplied with *total* nitrogen as those of Europe and America, they contain, when well fallowed, a larger proportion of *available* nitrogen than is usually found in far richer soils. The explanation for this is to be found in the unexampled activity of the nitrifying organisms in our northern wheat soils. Under the stimulus of moisture conserved in a good bare fallow, and the free permeation of air allowed when the soil is well mulched, combined with the high soil temperatures ruling in our warm climate, the nitrifying organisms have three conditions essential for perfect development. On the other hand, the exclusion of air and low temperatures hinder their development and frequently promote the opposite process, denitrification The extent to which these factors aid or hinder this process is being made the subject of further investigation.

(6) Tests such as these could be carried out to much better advantage if the soil samples could be taken from specially-constructed drain-gauges, where the whole body of the soil would be more or less under proper control. Such drain-gauges are costly to construct, and, though they are invaluable for the accurate observation of soil changes, they make the soil conditions somewhat different from those that obtain in an ordinary field. The cost of construction of the drain-gauges, and the desire to carry out the experiments under ordinary field conditions led to establishment of these field plots at Longerenong. The experiments will be enlarged in scope, and repeated at the Central Research Farm. Werribee, during the coming season.

SUNFLOWER SEEDS IN RUSSIA—

Of late years cultivation of the sunflower has increased enormously in Russia. The shells are sold for heating purposes, the stalks dried in piles are preferred to pine wood for producing a quick and hot flame, while the seeds yield an oil which is highly valued for culinary purposes. According to *Fertilisers,* each acre yields about 2,000 lbs. of this firewood and some 1,350 lbs. of oil. The oil cakes are considered superior to hemp or rape cakes, and upwards of 2,000,000 lbs. are exported by the Government of Saratoff alone. Out of 104 mills in Russia, 85 are employed solely in obtaining sunflower oil.

TOMATO CULTURE IN VICTORIA.

(*Continued from page* 346.)

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

SOILS, ASPECT, MANURE.

The tomato does best in a fairly rich, loamy, and well-drained soil. It is not necessary to particularize locality soils, everything depends on the preparation of the soil, and the feeding of the plant. A proper aspect in hilly districts is north or east. On the flat surfaces of the northern plains, and on the sedimentary flats so favored by market gardeners, aspect cannot very well be considered. Artificial means are resorted to, to prevent frost and cold from causing injury to the plants. The tomato is a gross feeder, and will produce a large plant with a quantity of late fruit if too liberally treated with nitrogenous manures. The growth required is steady matured growth in all stages of its development, consequently soils over rich in nitrogen are better avoided. This is frequently the case where fresh stable manure, in excessive quantities, is applied to the soil. Stable manure, well rotted, applied at the rate of 20 tons to the acre on poor soils will be found sufficient; on richer soils a less liberal dressing will suffice. Stable manure is the best manure to use for tomatoes, and in all classes of intense culture, as it adds humus to the soil, changes its physical condition, and contains to a greater or less extent nearly all the food requirements of the plant. The manure should be spread over the surface and ploughed under in the autumn, or if any winter crops, such as cabbages or cauliflowers, have been grown, the manure should be spread and ploughed under as soon as they are removed. When the tomatoes are being planted, bone dust is nearly always applied at the rate of a handful of bone dust to each plant. Bone dust is the artificial manure generally used for tomatoes. It is slowly soluble, and the quantity given is sufficient to last the plant through all its stages of growth.

Where stable manure is not available in large quantities, and artificial fertilizers have to be used instead, the manure to be applied should be rich in phosphoric acid and potash, with sufficient nitrogen to produce a free, but not over luxuriant growth of plant. The tomato-grower should remember that fruit is the objective. The same ground should not be used for tomatoes for longer than four or five years in succession. New ground should be brought under cultivation, and the old ground treated with a dressing of lime at the rate of half a ton to the acre, and given over to the production of other crops, for two or three years, when tomatoes can again be grown on the same ground. This is for the purposes of keeping down diseases, which will be dealt with under another heading.

PLANNING SURFACES.

The tomato requires frequent irrigation, consequently the surface must be planned so as to facilitate watering and cultivation. On almost flat surfaces the system usually adopted by the Chinese is shown in Plate 1.

Plate 5 shows the European system at Bendigo, introduced by the Spaniards twenty years ago, and probably is the finest system

of irrigation for intense culture on either flat surfaces or steep slopes known. The intense culture irrigationist of Bendigo and district is an adept in the skilful use of water on small areas.

After ploughing and harrowing, the whole area to be planted out is planned and laid out according to the contour of the surface.

Plate 5 shows a section of a field on a fall of approximately 1 in 80, as shown by contour lines 400′ and 399′ 25″. The distributary

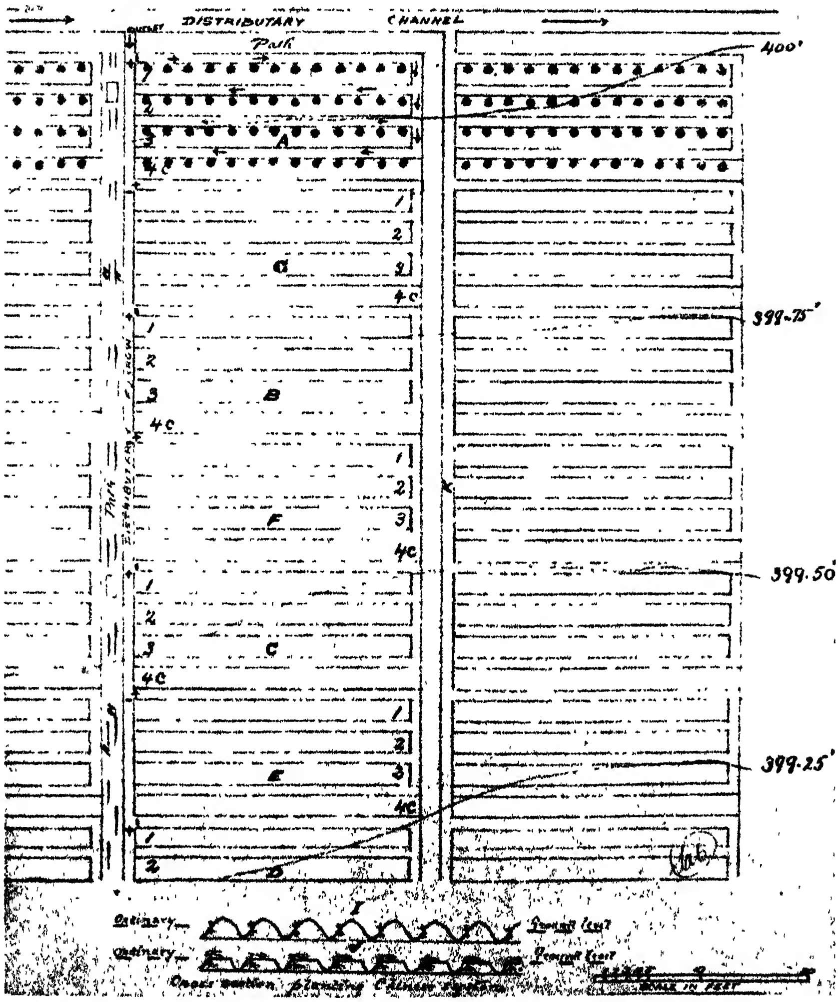


Fig. 5.—Ground plan of Tomato field, Bendigo and Echuca systems, planned for irrigation and hand cultivation.

furrows are brought down with the fall, and the lateral furrows are placed at right angles following as nearly as possible the lines of contour or levels. This system can be adapted to any greater fall, or on an almost level surface. In the Chinese system the distributary channel is a permanent one, and is brought down the centre of the path, as shown in Plate 1 and in Plate 5 by dotted lines marked H The three squares along the line of flow represent deep boxes inserted

in the ground, and are used for dissolving manure, whence liquid manure can be applied during the process of watering. Outlets are

Fig. 6.—Planting tomatoes, Chinese system, Echuca.

made from the channel marked *H* into the distributary furrows at required intervals. Under this system of irrigation, handwork with

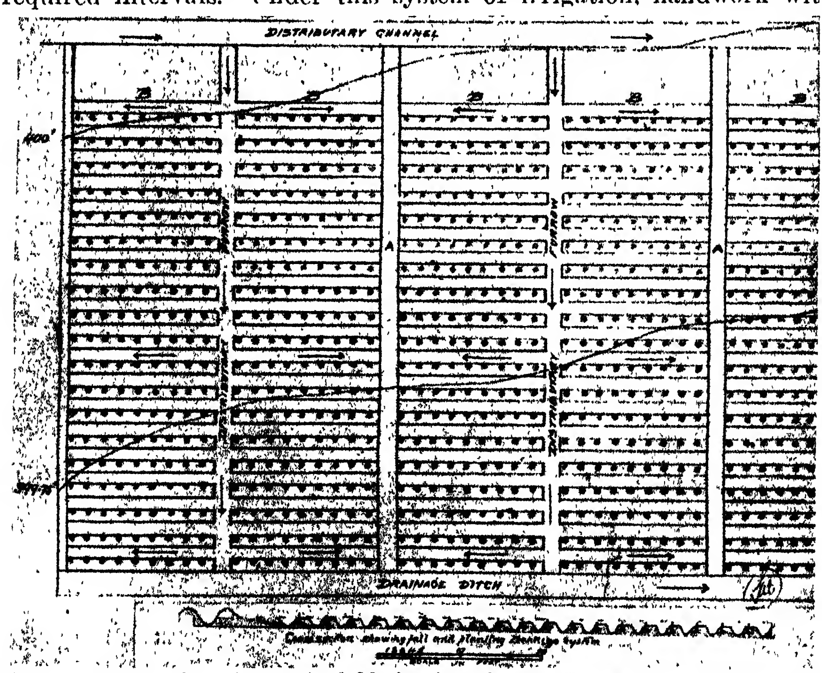


Fig. 7.—Ground plan of Tomato field showing plants 3 feet x 2 feet, and planned for irrigation and horse cultivation.

the hoe is the only system of cultivation after the surface has been planned and planted. A cross section is shown at I, showing lateral furrows, and also in Plate 6. Plate 7 shows a good system to be

adopted on fairly level surfaces. The fall here shown is approximately 1 in 160, the distributary furrows are taken down the fall which is marked at 400′ and 399′ 75″, and the water spread right and left along the level lateral furrows as indicated by arrows. This system lends itself to horsework at all times, cultivating right along the lateral furrows, and striking out the distributary furrows afterwards,

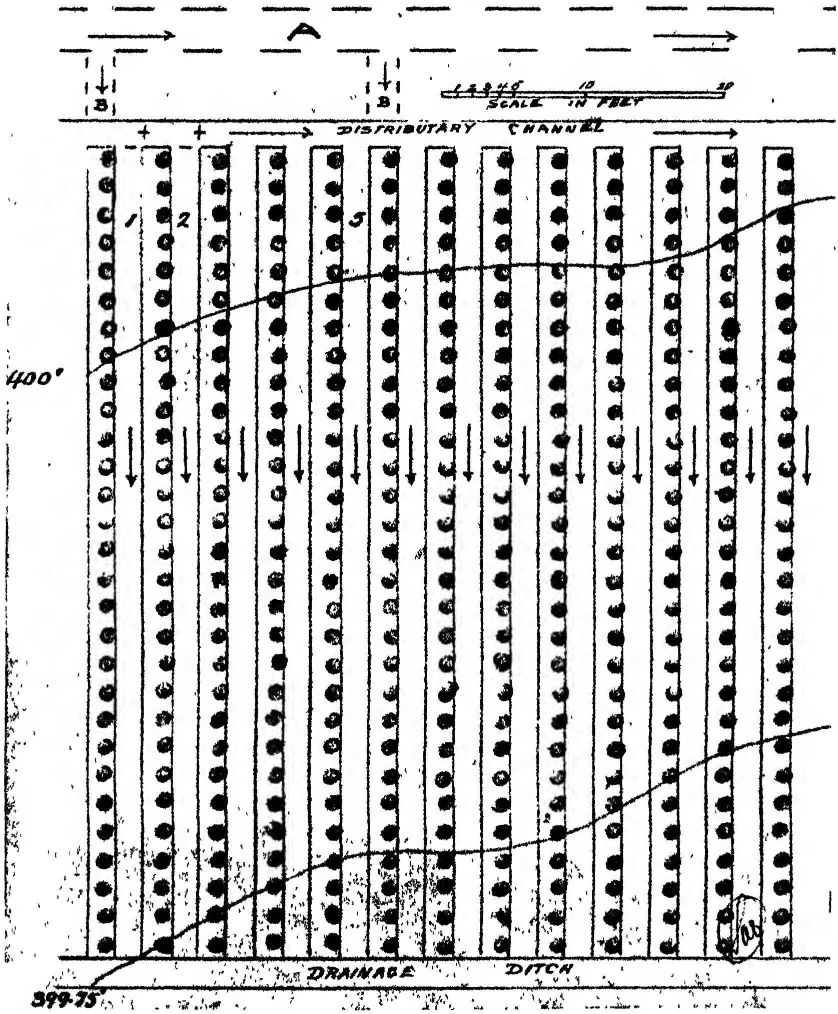


Plate 8.—Ground plan of Tomato field showing plants 4 feet x 2 feet planned for irrigation and horse cultivation.

leaving a headland marked B of sufficient space between the distributary channel and the first row of tomatoes for a horse to turn on. A third system is shown in Plate 8, where the fall is approximately 1 in 160, and this system can be adapted to greater or less gradients, provided always that the fall is not sufficient to cause scour in the furrow. In this system the distributary channel is brought along the level, and the water turned into the lateral furrows in turn, or a larger number of furrows may be irrigated at the same time by using

a larger volume of water. Under the Chinese system the tomatoes are generally planted 4 feet between the rows, and 1½ to 2 feet apart in the rows. On the Bendigo system the planting is usually 2 to 3 feet between the rows, and 1½ to 2 feet in the rows. A good distance apart for planting will be found in Plate 5, 3 feet between the rows

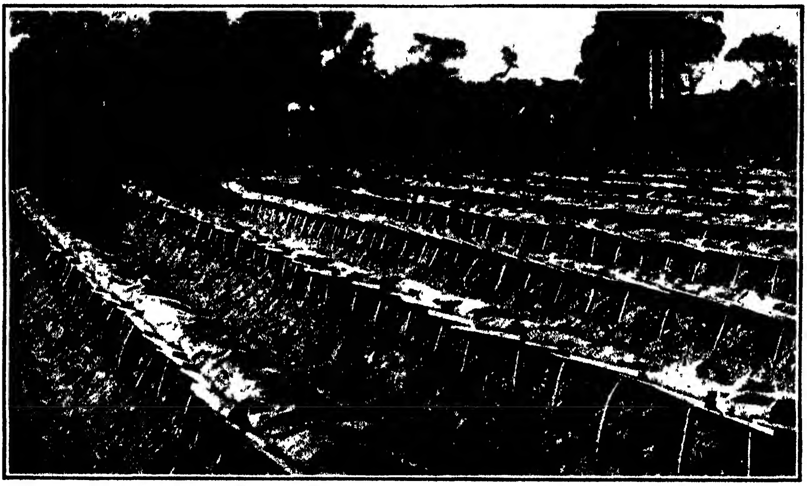


Plate 9.—Tomatoes covered to protect from frost, Chinese system, Echuca.

and 2 feet apart in the rows, 7,260 plants to the acre. Plate 8 shows 4 feet between the rows and 2 feet apart in the rows. 5,445 plants to the acre, a good distance apart for tomatoes not staked.

After the surfaces have been planned according to the distances the plants are to stand apart, planting takes place. Plate 6 shows the

Plate 10.—Tomatoes covered to protect from frost, European system, Bendigo.

PLANTING, COVERING, STAKING, PRUNING.

Chinese system. The plants are lifted from the cold frame in the tins as shown by + Plate 4. In early planting the furrows are made east and west as nearly as possible, and the tomatoes planted on the northerly side of the ridge to protect them from the frost drift from the south.

The soil is removed as shown midway up the ridge with a shovel, forming a sort of circular recess, a handful of bone dust is mixed with the soil in each recess, and the tomato, carefully removed from the encircling tin so as not to disturb the earth from the roots, is

Plate 11.—Tomatoes growing on levelled ridges after frost covers are removed, Chinese system, Echuca.

planted here. The soil is packed around the plant, and a little brought forward and ridged to form a small basin for the water, which is applied to every plant after planting.

On the European system at Bendigo, planting takes place later, consequently the furrows are not so highly ridged, and very little

Plate 12.—Tomatoes and onions, Chinese system, Echuca.

covering is done. The ridges are fixed at permanent heights, and on these the tomatoes are planted, with similar care as to manure and watering as in the Chinese system. Stock plants should always be kept in reserve, as sometimes late frosts may do a lot of damage.

Covering to protect against frost is shown in Plate 9, Chinese system. Boards 2 feet x 1 foot are used, and placed as shown on the ridges, and extend right over the plants with a good open slope, and are held in position by little props underneath. On the top of the boards hessian coverings (bagging may also be used) are placed, and soil placed on the hessian to hold both board and hessian securely in position. The hessian coverings are let down over the plants at night if frost threatens, and thrown back as shown in the day time. Another system is shown in Plate 10, where the covering boards or "slats" are placed endways over the plants, and no hessian covering is used. When the danger of frost is over the boards and coverings are removed, and stacked until required in the following season. Under the Chinese system the earth on the ridge is now brought forward and backward into the furrows to the ordinary soil level, as shown in Plate 11, and in cross section J, Plate 5. This leaves a furrow large enough for irrigation, with a flat surface on the ridge, at A with the leader or terminal growth at C, and the flower clusters

Plate 13.—Tomatoes staked, European system, Bendigo.

on which the plants grow, twice the width of the furrow. On the Bendigo system the plants are staked or trellised, and the ridging or furrows are not altered once they are planned. Should it be thought that too much ground is taken up under the Chinese system, Plate 12 shows a row of onions planted along the edge of the ridge opposite the tomatoes. When the tomato plants are about a foot high, they are staked as shown in Plate 13. Stakes are made from small saplings, and are usually 3 feet long, 1½ inches in diameter, and are pointed at one end, and driven into the ground about 6 inches deep alongside each plant, inclining one stake towards the other in the row, or inclining the stakes in one row toward the stake in the other row. The plants are tied to the stakes at regular required intervals, tying tightly to the stake and loosely around the stem of the plant. Trellised tomatoes are shown in Plate 2.

Pruning is necessary for production of early fruits. Plate 14, Fig. 1, shows the lateral growth produced from the axil of the leaf

at B. Fig. 2 shows the lengthened growth of laterals at D. Terminal or leader growth at E, fruit clusters on the main stem F, and flower clusters on laterals at G. If all these lateral and leader growths were allowed to remain, there would be an increased crop, but late ripening of the fruit, as unchecked lateral and leader growths do not promote early setting of the fruit. Lateral growth should be pinched out as soon as it appears as shown, Plate 15, Fig. 1. This will promote the production of flower clusters, and setting of the fruit. When two or three flower clusters have been produced, the leader is stopped at one leaf above the cluster of flowers as shown, Plate 15, Fig. 1. The plants should be looked over every week to keep down lateral growth until flowers are produced, and the leader checked. The checking of

Plate 14.—Tomatoes staked and tied, showing lateral and leader growth.

the leader turns the energies of the plant to the growth and maturing of the fruits already set. If the laterals are not removed the plant generally drops its first flowers and earliest fruits. The large crown flower on the side of the cluster will mature into a misshapen fruit if allowed to remain. It is necessary on the cluster for pollination purposes, but it should be ultimately removed. This is done when the rest of the fruit on the cluster has formed.

Plate 15, Fig. 1, shows plant staked and pruned to two clusters of fruit. Fig. 2 to three clusters of fruit. Should trellising be adopted, as shown, Plate 2, lateral growth is permitted after the first two or three clusters of fruit are set. The laterals are tied to the cross ropes or wires, and the point of growth pinched after a cluster

of fruit has formed. The pinching or cutting out of large laterals, as shown at D, Plate 14, Fig. 2, is very injurious. They should be pinched out when 1 or 2 inches long. If they are allowed to remain and develop leaves and woody tissue, this is done only at the expense of other parts of the plant: the removal of large laterals upsets the balance between leaf and root surface, and causes injury. Pruning increases the size and colour of the leaf, hastens the setting of the fruit, and increases its size. The Chinese check all lateral growth until

Fig. 15.—Tomatoes pruned, leader and lateral growth removed.

the flower clusters are formed; they then pinch the leader, and after that allow the plant to grow at will on the ground. In staked plantations where tomatoes are more thickly planted, it will be found necessary to keep down lateral growth for some weeks after the leader has been checked. This is to allow the free access of light and air to the plants. This thinning, however, should be of such a character as to retain sufficient foliage to prevent sun scald of the fruit. Tomato plants allowed to grow unchecked may produce more fruit, but this is compensated for by closer planting on the staking system, the increased size of the fruit, greater facilities for keeping down disease, and bigger prices through early ripening.

(*To be continued.*)

THE FERMENTATION OF CIGAR LEAF.

By Temple A. J. Smith, Chief Field Officer.

The fermentation of cigar leaf in America is not, as a rule, done by the grower, but is undertaken by the middleman or dealer, who regrades and treats the leaf according to requirements. In Victoria we have no one doing this work, consequently it devolves upon the grower or manufacturer; as the latter is in the habit of purchasing his leaf already treated and prepared for manufacture, he is not conversant with the methods of fermentation, and is, therefore, not inclined to bother with the unfermented article. The grower must, for some time to come, undertake this part of the work; no doubt in the future, when cigar leaf of Victorian production is more generally grown and used, dealers will be found to carry out such operations. Fair sized bulks are necessary for successful and economical fermentation, and as cigar leaf should be classed into at least six grades to suit the trade, it will be readily seen that fairly large quantities would have to be handled by a middleman to insure a profitable business.

It is my intention to deal as fully and clearly as possible with the subject in its different phases, showing the changes which the leaf is subjected and the various modes of treatment. This is necessary, as the amount of fermentation required depends upon the leaf itself and the purpose it is used for, heavy-bodied leaf requiring a longer and more exhaustive treatment, while light, thin leaf will neither stand nor require so much. After the leaf has been cured in the shed, it is practically dead, so far as the leaf-cells are concerned; at the same time if sufficient moisture is absorbed or applied to the leaf, and it is packed closely together, fermentation takes place and heat is generated and thrown off. This process is again due to enzymes or ferments, and these must be suited by certain temperatures and moisture conditions before they can act. The best temperatures in the sweating room are from 75 to 100 degrees Fahrenheit, and the degree of humidity from 70 to 90 degrees. These conditions can be maintained by stoves and steam, and it must be borne in mind that these remarks apply to the treatment of cigar leaf which requires a much higher and more complicated fermentation than pipe tobaccoes, and unless the operator understands his work, or follows the directions given closely, unsatisfactory results will ensue. Fermentation will, if properly conducted, get rid of any surplus vegetable matter in the leaf, will bring out the aroma and improve the colours; the combustion, or burn, will also be far better, and the general smoking qualities enhanced. There is a loss of weight during fermentation of from 2 per cent. to 15 per cent., partly due to moisture and partly due to solid matter thrown off through the decomposition of different elements and the formation of gases, the changes being both chemical, and, in some degree, owing to life processes. The starches in the leaf change to sugar, and the sugar is consumed in the curing, the remainder of both being driven off in fermentation. The enzymes attack the protein, nicotine, and tannin in the leaf, thus reducing the bitterness found in unfermented tobacco. Nitrates and fat are also attacked and destroyed. and the burning qualities thereby made better. The natural

gum and resin is reduced, and the leaf, when fermented, has a dry clean feel as compared with its original condition. Citric, malic, and oxalic acids are partially changed into acetic and butyric acids.

During the fermentation amido compounds are formed, and the smell of ammonia is present. This is a natural result of the process, as also is the appearance of a light whitish powder, resembling a dry mould. This is due to an excess of magnesia, lime, or salt in the tobacco, and these can be taken off with a spray of weak vinegar in solution, or by brushing, when dry, with a light hair brush. The general tendency in Victoria has been to terminate the fermentation process too soon, and before the salts mentioned have been driven out; no definite rule as to how much fermentation should be given can be set down, as some tobaccoes ferment slowly, others fairly fast. In some cases the enzyme or ferment is present in greater numbers, and soil constituents and climate have their effects, causing an impetus, or check, as the case may be, on the leaf's condition. Consequently each tobacco will need to be treated according to its special condition. Wrapper leaf and filler leaf should be fermented separately, as each will have to receive different degrees of treatment. Careful observation during the process is essential, and the use of thermometers desirable, notwithstanding the fact that many operators depend on their sense of touch and the appearance of the leaf during the different stages of development.

BULK FERMENTATION.

A room for this purpose should be so built that the temperatures can be regulated at will, also the humidity; the latter can be best controlled by steam pipes, which are placed close to the floor round the room, and are supplied by a boiler outside. Heat is also generated in this way; the temperature of the room should be kept as nearly as possible to 100 degrees Fahrenheit, and should not be allowed to drop below 85 degrees F. during the process. Fermentation takes place when the temperature reaches 75 degrees F., but the best effects are brought about with the temperature over 85 degrees F., and under 110 degrees F.

For heavy coarse leaf, the latter degree of heat can be reached without fear of damage, but for fine thin leaf it will be safer not to exceed 98 degrees to 100 degrees F. Close fitting windows or shutters are required, so that the room can be easily cooled down by opening them, or an even temperature maintained while they are closed.

A stage or floor should be built, about a foot from the floor, 5 feet wide by 10 feet or more in length; such a stage can be easily constructed by laying ordinary flooring boards across joists 2 ft. 6 in. apart on the floor of the shed. It is a good plan to have bulk heads at each end of the stage the width of the floor, and at least 5 feet in height; if the stage is more than 10 feet long, a bulk head in the middle is also advisable.

The tobacco is prepared for fermentation by spraying with a fine spray of water on the hands or bundles, which should be placed in layers to receive it, each layer being two hands in depth. The leaf should contain from 20 to 24 per cent. of moisture, evenly distributed, light thin leaf containing the smaller quantity, and heavy leaf the

larger. It sometimes happens that in very moist weather leaf containing a large percentage of gum will absorb sufficient moisture without any artificial application, and such a condition is very satisfactory. The system for testing the amount of moisture in tobacco is simple. A parcel of, say, 10 or 20 lbs. of leaf is weighed, and the moisture content then dried out by slow heat in a stove, and when thoroughly dried again weighed, the difference in weights giving the percentage of moisture, as, for instance, a 10-lb. parcel losing 2 lbs. in weight under the treatment would have contained 20 per cent. of water. It is never wise to apply water to pipe tobacco leaf, as these tobaccoes require a far simpler fermentation than cigar, and will go through the necessary process with a smaller moisture content, such as will be absorbed by the leaf itself in moist weather.

After spraying cigar leaf, the hands or bundles should be packed in heaps for 24 hours, to allow the moisture to become evenly distributed before bulking on the stage, in order to obtain a uniform condition throughout, otherwise one portion of the heaps may reach the rotting stage before other portions commence to ferment. The floor of the stage should be covered with a couple of inches of clean straw or old tobacco trash. The better grade hands are then laid on the floor, beginning at the outside edges, laying the hands close together, with the tips of the leaves to the centre and the butts to the outside, keeping them level and closely packed together; care should be taken not to double any of the leaves back, but to keep them straight to their full length. Having completed the row of hands on each side of the bulk, the next row is placed with the butts lapped half-way up the first row, and so on until the different rows meet in the centre. Each succeeding layer is put on in the same way, and the stacker should not get off the bulk until it is finished, but should have the hands given to him in pairs, and knee them down in order to pack the tobacco closely and solidly, keeping each layer as level as possible until packed to a height of 4 ft. 6 in. or 5 feet. It is a good plan to make the two top layers of inferior grade leaf and to build the centre of the bulk higher than the sides to finish off, as during the fermentation process the middle will sink more than the sides. During the building, at intervals of 5 feet, a galvanized tin pipe perforated with holes to admit air should be built in with the tobacco about the centre of the bulk, and in this a thermometer, suspended by a cord, is placed, which can be drawn from time to time to ascertain the changes in temperature. When finished, the whole of the bulk tops and sides should be covered with trash tobacco and hessian or old tarpaulins, placing slabs, or any convenient weights, to evenly compact the whole. The tops of the galvanized pipes should be corked up to prevent the access of air from outside.

The degree of fermentation to which each class of tobacco is subjected depends entirely on the leaf itself, and the purpose for which it is required. Thin wrapper leaf, in which it is desired to keep a light colour, should be put down with only 15 per cent. of moisture, and be very lightly fermented; in fact, allowed to sweat, a more applicable term, for to submit such leaf to a heavy fermentation would result in turning it nearly black and destroy its elasticity and textile strength, ruining it for wrapper purposes. The fact that its flavour

would not be developed to the full is of small account, as wrapper leaf must be thin, and consequently is a small proportion of the cigar. A pound of Sumatra wrapper leaf will cover 500 cigars. Bunch wrapper is the leaf immediately beneath the cover, and is of heavier character than the outside, and requires a greater degree of fermentation, but not so much as will destroy its elasticity, as its function is to hold the filler leaf in shape. Colour is not of much importance, but it must have good burning qualities and flavour, and for this latter reason special leaf of some particular quality for blending purposes is often employed.

Filler leaf generally requires the greatest amount of fermentation, and as this portion of the cigar has the most influence on its smoking qualities, all organic matter must be expelled so far as is possible, and the flavour developed to the greatest extent. Only experience can determine exactly how far fermentation can be proceeded with in each case, as all tobaccoes of the different classes vary more or less in texture, body, &c.

The temperature of the bulk will begin to rise the second day after building, and should continue to do so at the rate of 10 degrees to 12 degrees F. each day. The thermometer should be examined each day to ascertain the rate and extent to which it has risen; if it rises faster than 12 degrees in 24 hours the whole bulk should be taken down and each hand shaken out, and the bulk rebuilt, putting the outside hands to the centre of the heap and *vice versâ*. Should the temperature rise slowly, there is no occasion to turn the bulk until the degree of heat reached is 110 degrees to 114 degrees. It may be necessary to turn the bulk three or four times, but it will be found that the heat will rise at a slower rate after each turning, and should it be found that no further increase of heat is made, the room can be cooled down by opening the ventilators and the bulk opened and spread to dry out all excess of moisture until the tobacco is just so dry as to admit of handling and packing without danger of rotting. It can then be packed in boxes to age or send to market. Filler and binder leaf will often smell a little musty and show a white powder on the leaf after fermenting, but this will not detract from its value, and if properly done, will feel dry and like satin to the touch, though pliable. The colour will darken, and, while in a moist condition, look almost black, but when dried out again will be a dark brown in heavily fermented leaf. Ageing by storing in boxes for a summer will improve the smoking qualities, and, if packed away for this purpose, the boxes should not be too close in the sides or tops, and are better lined with straw. Boxes holding from 80 to 150 lbs. are the most convenient sizes. Should it be found that fermentation in the bulk is too slow from some unknown cause, probably acidity, a spray of carbonate of ammonia in a 15 per cent. solution of water will accelerate the fermentation by neutralizing the acidity, thus making the general conditions more suitable for the working of the ferments.

There are several formulæ for treating low grade cigar leaf to improve flavours, but these should not be necessary, and depend largely on requirements.

Seeing that the fermentation is partly a life process and partly chemical, too much care cannot be taken in regulating the temperatures of the bulk. The ferments, or enzymes, on which depend the result of the treatment are killed at temperatures of over 130 degrees F., and should such a degree of heat be reached, no further fermentation will take place, but decay will set in; on the other hand, if temperatures below 70 degrees F. obtain, there is no development of the enzyme and fermentation is delayed. Cigar leaf is sometimes put through a slow ferment in boxes kept in a uniform temperature, with a small moisture content, over a long period, but such methods are slow and unreliable, and, except where only small quantities are being treated, not advisable.

MARKETING FARM PRODUCTS—

A bulky report furnishing a survey of the various systems of marketing farm products throughout the Republic has just been submitted to Congress by the United States Secretary of Agriculture. The report also puts forward a number of tentative suggestions designed to aid the producers, and as an aid to carrying these into effect, it is recommended that a "Division of Markets" be established. This division would be provided with a corps of travelling field agents, and a large corps of local agents and correspondents. Among its duties would be—(1) to help producers to market co-operatively or through a non-co-operative agency, (2) the examination of local difficulties, (3) to help producers to find markets, (4) to report the current descriptive condition of crops in addition to the work already done for principal crops only, (5) to estimate the probable production of crops a short time before harvest, (6) to report the beginning and ending of the shipping season from places of chief production, (7) to ascertain routes, methods, time, and costs of transportation, (8) to investigate storage rates and accommodation, (9) to establish lists of honest and trustworthy commission agents, (10) to describe methods of sale, monthly supplies, hours, and local fancies of customers at different markets, (11) to make, keep, and publish records of producers' prices, wholesale prices, and retail prices, (12) to make and publish lists of marketing associations, buying associations, and agencies of associations of consumers, and the business done by marketing associations, (13) to investigate systems of marketing in other countries. A general market news service by telegraph or mail is not recommended. It is recognised that the new division of markets could not reach its full activity at once, as time would be required to bring lines of service up to smooth effective work, and also to ascertain in what particular directions the activities of the division should specially develop. In these circumstances an appropriation of £20,000 is suggested towards the costs for the opening year; but this expenditure is expected to increase when the work is properly organized.

PROFITABLE DAIRYING ON SOUTH GIPPSLAND HILL COUNTRY.

RETURNS FROM A HERD OF 20 COWS OWNED BY MR. ALFRED BOX.

By J. Fleming, Dairy Supervisor.

This farm, of about 95 acres, is situated on Jeffries' Creek, near its junction with the Albert River, about 22 miles north-west of Alberton. It is typical grey soil, hill country, most of it rather steep and broken, with northern and southern slopes to the creek running through it. The creek flats are small and narrow. Very little fodder is grown, as the farm is too steep and too heavily timbered to allow of much cultivation, although kept very free of bracken and undergrowth. The pasture is a mixture of rye, cocksfoot, and clover, cocksfoot predominating on the hills. Weighing, for the first time, commenced on 24th August, 1911, and was continued until the end of season, with some striking results, as under:—

Name.	Weeks in Milk.	Milk.	Average Test.	Butter Fat.	Average Price.	Cash Return per Cow.
		lbs.		lbs.	s. d.	£ s. d.
*Poley	39	3,613	4·6	166·19	1 1	8 19 10
*Brindle	32	3,693	4·8	177·26	1 1	9 11 0
*Bess	36	3,739	4·7	175·73	1 1	9 10 4
Darkie	34	5,856	4·4	257·64	1 1	13 18 11
Brownie ..	39	5,232	4·2	219·74	1 1	11 18 0
Cherry	37	3,680	4·7	172·96	1 1	9 7 2
Fancy	37	5,163	4·9	252·98	1 1	13 14 1
Dairymaid ..	37	4,196	4·8	201·40	1 1	10 18 0
*†Jane	31	2,541	4·7	119·42	1 1	6 9 2
*†Lily	30	2,184	4·8	104·83	1 1	5 13 5
Lass	40	8,016	4·2	336·67	1 1	18 4 6
†Beauty	40	4,123	4·9	202·02	1 1	10 18 0
†Madge	35	3,517	4·2	147·71	1 1	8 0 0
Blossom ..	32	5,332	3·7	197·28	1 1	10 13 8
Nancy	33	4,585	4·4	201·74	1 1	10 18 6
†Princess ..	36	2,941	4·8	141·16	1 1	7 12 9
Pet	33	4,144	4·3	178·19	1 1	9 12 10
†Jubitor	33	2,993	4·2	125·70	1 1	6 15 11
Daphne ..	41	6,014	4·3	258·60	1 1	14 0 0
Jennie	38	4,510	4·7	211·97	1 1	11 9 8
Total ..	..	86,072	..	3849·19	..	208 6 7

* These three cows were in milk some time before weighing commenced.
† Were two-year-old heifers.
*† Have been dispensed with on their returns per scales and test.

Milk from each cow was weighed every day, night and morning. Samples for testing were taken on the following dates:—19th and 27th October, 9th November, 12th and 22nd December, 4th, 11th, and 18th January, and 8th and 28th March. Each cow was tested, on an average, three times. The tests of each cow have been averaged. The milk was tested by the Butter Factory manager. A great difference in the production of the best and the worst cow will be noted. One

produced over 800 gallons of milk, containing 336½ lbs. of butter fat, worth £18 4s. 6d.; the other produced only 218 gallons of milk, containing 104¾ lbs. butter fat, worth £5 13s. 5d., a difference of 231¾ lbs. butter fat, worth £12 11s. 1d. between the best and the worst cow in a herd of twenty. The ten best cows averaged 530.1 gallons of milk per cow, with an average butter fat return of 234 lbs., worth £12 13s. 6d. per cow. The five worst cows averaged 283.2 gallons, with an average butter fat return of slightly over 127 lbs., worth £6 18s. 3d. per cow. Notwithstanding this, the averages for the whole herd were 430.7 gallons milk, 192.9 lbs. butter fat, worth £10 8s. 4d. per cow. The monetary returns are calculated from the average price paid for butter fat by Mr. Box's factory for the period over which the weighing and testing extended.

So interesting and instructive were this season's figures that it has been decided to continue the practice of weighing and testing each cow's milk. It may be mentioned that the majority of this herd are pure and grade Jerseys. The balance show some Ayrshire breeding. Lass, the cow that produced over 800 gallons of milk, is about three-quarter bred Jersey. Two pure bred Jersey bulls are kept. Mr. Box is putting together a small Jersey stud, which has at the head of it the four-year-old bull Comparable's Lad, by Lily 4th, Defender, from Comparable, who was guaranteed up to 18 lbs. butter per week, and is by Canterbury's Lad, from Favourite 2nd. Mr. Box has also secured from Miss Robinson Lotina's Noble of Oaklands, who is now one year old. He is by Lucy's Noble of Oaklands (imp.), from Lotina (imp.), both of whom were reserve champions at Melbourne Royal Show. With bulls like the above to breed from, and the selection of heifer calves from the *known* best cows, Mr. Box should have no difficulty in raising his average production per cow considerably before very long. If a system of weighing and testing were generally adopted by dairy farmers, and the inferior animals culled, their profits would be materially increased, and the returns from dairying generally enormously enhanced. The system of pedigree herd testing inaugurated by the Department of Agriculture should do much to assist these farmers, as they will be able to choose bulls from tested cows with greater certainty of improvement in the heifers. A long pedigree does not necessarily indicate that the animal is capable of producing a profitable amount of butter, often the contrary is the case, hence the value to be derived from this system of herd testing. As they become known, the unproductive strains will be neglected.

In fat animals about 80 per cent. of the ash constituents is found in the bones. Bone ash is chiefly prosphate of lime, with a little carbonate of lime and phosphate of magnesia.

Don't drive the boy off the farm. Arrange the farm work so that he will like it.

JOINT ILL AND WHITE SCOUR.

DISEASES OF FOALS AND CALVES CAUSED BY INFECTION THROUGH THE NAVEL AT BIRTH.

By R. Griffin, M.R.C.V.S., Veterinary Staff.

It may not be generally known that probably the most fatal of all diseases of foals and calves is caused by the invasion of a specific organism or germ through the navel at or soon after birth. On several occasions in Victoria I have seen foals affected with Navel Ill, the owners being unaware of the nature or cause of it. Those breeders, however, who know the fatal nature of Navel Ill take every precaution to prevent it, and if their farm has already been infected with the germs of this disease go so far as to remove their breeding animals, prior to foaling or calving, as the case may be, to a farm where Navel Ill has never existed. When once a farm becomes infected with the germs of the disease it is a most difficult undertaking to eradicate them, and those farmers who take the precaution of removing their breeding stock to a farm which may be classed as " clean " prior to such removal, wash the animals all over with a disinfectant in order to minimize as much as possible the risk of carrying the germs of disease to their new location. The annual loss by death of foals and calves from disease due to navel infection must be very great, especially on those farms where the breeder is unable to adopt any preventive measures, as he is unaware of the nature and cause of the infection. Consequently in certain districts of this State a large percentage of the foals continue to die from what is termed " a mysterious disease."

The two diseases that will be discussed in this article are " Navel or Joint Ill in Foals " and " White Scour in Calves." In each it is caused by the entrance of a specific organism or germ through the navel opening. In foals producing Navel Ill with secondary infection in the joints and internal organs. In the case of calves, White Scour, and possibly joint lesions as well.

To better understand how this secondary infection in joints and other organs takes place a short description of the umbilical, or navel cord, its structure and functions, may be helpful. The umbilical, or navel. cord is the connecting link between the fœtus, or young, and its parent. It is made up of vein, arteries, and a tube called the urachus, and it is through these structures that the blood, which causes the development and growth of the fœtus within the womb, passes from the parent to its offspring, and the waste products from the fœtus are returned. At birth this cord is broken or cut, and it is through the several vessels that the specific organisms gain access to the system, and eventually give rise to lesions in remote parts, the so-called secondary infections.

NAVEL OR JOINT ILL.

As the above-mentioned diseases resemble one another in many particulars, the cause, symptoms, and preventive treatment of Navel Ill in foals may be taken, with slight differences, to be noted later, as

descriptive of both diseases. The cause, as already stated, is the entrance of a specific germ through the navel at or soon after birth. These germs, however, may be found in the vagina, or first passage, of mares prior to foaling, in which case infection would take place during the foaling process, but by far the most common source of infection is the insanitary condition of stables and foaling paddocks on farms where the disease has already existed. The cord coming in contact with the floor of the stable or earth in the paddock becomes infected, and in due course Navel Ill is the result. Infection may take place when the cord seems to have dried up; this is due to some grit or foreign substance getting entrance into the navel soon after foaling, which cause suppuration, and thus leave a channel through which the specific germs may gain entrance.

Persistent urachus, indicated by dropping of urine from the navel, is also a channel through which the germs may find entrance. Weak and insufficiently nourished foals are more liable to contract Navel Ill than strong healthy ones, on account of the want of vitality and practical absence of any protection against the invasion of micro-organisms of any variety.

SYMPTOMS.

In most cases the first symptoms observable are restlessness, colicky pains, and tendency to lie about. Later there is a disinclination to stand, refusal to suck mare, bowels are usually constipated, but occasionally diarrhœa may be present. Urine may be seen trickling from the navel in the event of the urachus not having closed. The navel may be swollen and painful, and this swelling may be felt, extending backward along the abdomen. Suppuration may also be present, and if the foal be made to move it is very stiff, and possibly one or more joints are swollen (usually knees and hocks).

It frequently happens that the first symptom is swelling of the knee and hock joints. The navel having dried up, and no swelling or pain being apparent in that region, the foal prefers the recumbent position, owing to the pain present in the joints; it refuses to take nourishment, and death ensues in a few days.

TREATMENT.

Treatment to be successful should be in the nature of prevention, for curative treatment in the majority of cases is most unsatisfactory, especially when not in the hands of a veterinarian who has a thorough knowledge of the disease and the structures involved, and is able to resort to surgery, if necessary, to aid in recovery, and to administer such serums as are indicated.

It is, therefore, strongly recommended that, if recovery is to take place, skilled advice should be early called upon, without recourse to the ordinary home remedies.

PREVENTIVE TREATMENT.

If this is properly carried out it is by far the most satisfactory, but it must not be undertaken in a half-hearted manner, but carefully, thoroughly, and regularly, until the cord has completely dried up and the danger of infection past.

As the germs of Navel Ill are most difficult to eradicate from a farm already infected, drastic measures must be adopted if success is to be achieved. If stables are of wood, and not of a permanent nature, burning them is the proper course to adopt; but if permanent thorough disinfecting must be carried out. Clean out and burn all litter, wash floors and walls with a strong solution of copper sulphate, then lime wash, with the addition of a pint of crude carbolic acid to each bucketful of wash; see that all corners are disinfected.

With regard to a foaling paddock which has been contaminated, mares should not be allowed access to it for some time prior to foaling; better still, it should be cultivated for a few years.

If foaling is to take place in stable, an ample supply of clean straw should be provided for bedding down, so that at foaling the navel cord does not come in contact with the floor; but if foaling is to be in paddock, select one with a plentiful supply of grass. This will also prevent the navel cord getting fouled with the clay or sand.

It is much preferable to allow foaling to take place in a paddock known to be free from infection than in a stable, no matter how thorough the disinfecting has been carried out. If it be considered necessary to irrigate with disinfectants the vaginal passages of the mare before foaling, one part of lysol to 100 parts of clean water that has been boiled and allowed to cool is a safe and effective douche, and can be injected with a syringe, or funnel with piece of hose pipe attached. The syringe or hose pipe should not be passed more than 3 inches into the vagina, and, in the case of a syringe, little force must be used. Tail and quarters should also be disinfected.

If possible, be with mare at foaling. This is not always possible, on account of the short premonitory symptoms and the rapidity with which a mare foals under normal conditions. If the navel cord has not broken during the act of foaling, it should be tied with tape or cord, previously disinfected, about 2 inches from abdomen, and then severed. Wash the cord with one part of corrosive sublimate in 1,000 of water, paint with tincture of iodine, and, lastly, dress with styptic collodium, a preparation known as new skin (which can be procured at a chemist's) will answer the latter purpose. This treatment should be repeated carefully each day until the cord has completely dried up. When disinfecting the cord, a space of a couple of inches round the navel opening should be included in the dressing.

In the event of the urine being observed escaping from navel, professional advice should be obtained.

WHITE SCOUR IN CALVES.

This disease, as already stated, is caused by infection through the navel, and, as the name indicates, is characterized by a white scouring, which is very persistent and difficult to arrest.

Some few years ago an epidemic of White Scour in calves occurred in Great Britain, and the services of Professor Nocard, of France, were secured, and, after careful investigation and numerous experiments, he found that the preventive treatment already described for Navel Ill in foals checked the progress of the disease, and in a short period practically eradicated it.

White Scour in calves should not be confounded with the diarrhœa due to dietetic causes. In the former there is stiffness, swollen joints, possibly discharge from navel, refusal to take food. rapid emaciation and death, whereas in diarrhœa caused by errors in feeding and internal parasites, practically all the symptoms of Navel Ill are absent, and with careful attention to food and proper medicinal remedies recovery will soon take place.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

MONTHLY REPORT ENDING 14TH JUNE.

The past month has been noted for its severity in weather conditions, as heavy rain fell during the month, followed by severe frosts. The thermometer registered 30 to 32 degrees on four mornings. Under these conditions, the egg production has been highly satisfactory, and in comparison with the former competition for the same period, the figures show an increase of 246 eggs, the totals being for 1912-13 competition 4,844, and the present one 5,090, and one pen less competing.

The system of feeding at the present competition is on similar lines to that followed last year. In the morning half pollard and half branning is used. Bullock livers are minced and mixed into the dry meal, and also a quantity of green food, consisting of grass, thistles and chick weed, which abounds in large quantities at present, the whole being well mixed into a crumbly state with hot meat soup. At mid-day wheat, bran, and pollard is given, mixed with hot soup, especially in cold, bleak weather. At night, wheat, maize (cracked) and oats mixed is the ration. In wet and frosty weather, cracked maize only is given. The birds in the leading pen No. 6 (Spotswood) are laying very consistently, but are being gradually overhauled by pen No. 23 (Gill). The leaders at present have laid 10 eggs above the leaders at last competition for the same period, viz., 257, a very good performance.

Moulting.—Several pens have entirely gone into moult, and quite a number have one or more birds so affected. This has considerably interfered with the output from these pens. These birds are, however, looking brighter and feathering quickly, while others are now entering into the moult.

Rainfall.—Measured for the month at the pens, 204 points.

Sickness.—Several severe cases of diarrhœa were experienced, and lately several mild cases of chicken pock, which has now almost disappeared. Stock generally are bright and alert.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition: April 15 to May 14.	May 15 to June 14.	Total to date—2 months.	Position in Competition.
6	White Leghorns ..	J. S. Spotswood ..	126	131	257	1
23	"	J. H. Gill ..	95	147	242	2
65	"	E. A. Lawson	104	133	237	3
61	"	Jno. Campbell	108	120	228	4
8	"	E. H. Bridge	93	124	217	5
21	"	A. Ross ..	107	106	213	6
48	"	Thirkell and Smith	72	140	212	7
46	Black Orpingtons ..	T. W. Coto.. ..	109	101	210	8
11	White Leghorns ..	C. J. Beatty	78	131	209	9
31	"	W. G. Swift	99	104	203	10
50	"	A. H. Mould	98	102	200	11
68	"	Jones and Curtis	93	104	197	12
66	"	W. Featherstone	94	97	191	13
16	Black Orpingtons	D. Fisher ..	76	113	189	14
2	White Leghorns	R. W. Pope	108	75	183	15
34	"	J. E. Bradley	86	95	181	16
35	"	Moritz Bros.	56	125	181	16
47	"	W. McLister	75	104	179	18
10	"	T. A. Pettigrove	62	115	177	19
40	"	Geo. Edwards	74	101	175	20
37	"	C. H. Busst	79	95	174	21
49	"	M. H. Noye	86	88	174	21
14	"	F. Hannaford	75	98	173	23
32	"	H. Hanbury	76	92	168	24
63	"	A. Sellers ..	80	82	162	25
45	"	D. Gouddie	85	76	161	26
7	"	H. McKenzie	62	98	160	27
41	"	Percy Walker	68	86	154	28
38	"	M. A. Monk	65	87	152	29
18	"	B. Rowlinson	68	80	148	30
27	"	J. Sinclair ..	66	81	147	31
39	"	W. Purvis ..	62	82	144	32
20	"	C. B. Bertelsmeier ..	29	115	144	32
3	"	S. Buscumb	60	83	143	34
26	"	B. Rolls ..	44	95	139	35
58	"	Stranks Bros. ..	45	92	137	36
59	S.C. White Leghorns	Cowan Bros.	78	58	136	37
43	White Leghorns	Morgan and Watson	52	83	135	38
53	Black Orpingtons	A. Greenhalgh	77	56	133	39
25	"	King and Watson ..	52	81	133	39
24	White Leghorns	Redfern Poultry Farm	45	87	132	41
62	"	G. A. Gent	74	49	123	42
67	"	C. Hepburn	58	64	122	43
28	"	E. Waldon	47	73	120	44
13	Black Orpingtons	T. S. Dallimore	79	37	116	45
22	White Leghorns	B. Mitchell	43	64	107	46
5	"	G. W. Robbins	27	76	103	47
55	"	P. H. Killeen	40	57	97	48
52	"	W. G. Osborne	42	53	95	49
57	"	Gleadell Bros.	32	59	91	50
44	"	W. A. Rennie	52	37	89	51
19	"	W. Dunlop	49	39	88	52
17	R.C. Brown Leghorns	S. P. Giles ..	34	54	88	52
12	White Leghorns	A. H. Padman	35	43	78	54
42	"	A. Stringer ..	15	43	58	55
56	"	Schaefer Bros.	15	40	55	56
33	"	South Yan Yean Poultry Farm	13	41	54	57
36	"	A. J. Jones.. ..	24	27	51	58
15	"	J. Shaw ..	24	23	47	59
30	Black Orpingtons	Jas. Ogden ..	15	27	42	60
51	Black Spanish ..	W. H. Steer ..	13	28	41	61
64	Golden Wyandottes	C. L. Sharman ..	2	33	35	62
9	White Leghorns ..	Sylvania Stud Farm..	10	24	34	63
29	"	S. Brundrett ..	19	11	30	64
54	"	Jas. McAllan ..	26	..	26	65
4	"	Jas. Brigden ..	12	13	25	66
60	Black Spanish	Watson and Rushworth	..	12	12	67
		Total	3,967	5,090	9,057	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Ploughing the orchard should now be completed; and, where necessary, the drainage system should be continued and increased. A dressing of stable manure should now be given wherever it is needed; and, if any artificial manures are to be used, especially if in the form of bonedust or potash, they should be applied now, so that they will be available as food for the roots in early spring. A dressing of lime may be given with great advantage to heavy, cold, or sour soils.

Spraying should be started for aphis, mite, and scale troubles; and, if the pest is at all severe or obstinate, the work should be done before pruning. Crude petroleum, red oil, and kerosene emulsions are all useful in dealing with these pests.

PLANTING.

The planting of deciduous fruit trees will still be continued on the lines laid down in last month's notes. Care should be taken to have the soil thoroughly sweetened and aerated, the roots should be well trimmed, and the young trees firmly planted. Owing to the time that elapses between the removal of the tree from the nursery row and the planting of the tree in its permanent situation, practically the whole of the fibrous and feeding root system has been destroyed. It will be well to remove all of the finer roots, and to thoroughly trim back the stronger ones; this will allow the tree to make a new root system for itself.

PRUNING.

After planting, young trees should be pruned severely back, usually removing far more than is retained. One reason for this is that it is necessary to do so on account of the severe cutting back of the roots. It is also necessary to prune hard because, as a result, strong growth will invariably follow. The severe cutting back of young trees is not only followed by strong growth, but the trunk and main stems are considerably increased in size. This latter result is an essential, as in thus giving a strong framework to the tree, it is being built up and strengthened for the carrying of heavy crops in later years.

In pruning back the newly-planted trees, they should be deprived of all light growth, and either one, three, or four main arms left. These main arms should be cut back to outside buds, leaving about 3 or 4 inches of wood. It is not necessary that the buds should be immediately in the line of the old growth; it is usually found that two, or perhaps three, buds will break away from each arm after pruning, so that in pruning it should be observed that, while the buds are in outside situations, they should be in such positions that, when they ultimately grow, there will be an even spacing between the growths. It, therefore, may be necessary to prune so as to have one bud in the direct line of growth, and the others as side buds. It is not wise to prune a young tree to two arms, as this would in future

years place too great a stress on the trunk; one side might possibly be overloaded, and would have a tendency to break away from the main system. The same hard pruning should be observed for the two subsequent prunings, the object of the pruner being to produce a strong, sturdy type of tree with evenly-spaced arms, all breaking away low down. The habit and character of the tree will determine the number of arms to be finally retained. A tree of spreading habit would naturally have more than one of an upright habit of growth. A spreading tree could be allowed later on to form an internal framework, while an upright-growing tree could be induced to produce a few outgrowing leaders.

After the third or fourth year, the aim of the pruner should be towards production of fruit-bearing wood. During these years, the tree has not been unmindful of this, and quite a number of weak lateral growths will have been produced. These may always be retained unless they become too long and spindly, when their length may be somewhat reduced. These laterals will produce all along their length a number of fruit buds, and they are thus valuable wood. A strong-growing lateral may always be shortened back, or cut out altogether.

Fruit buds may always be distinguished by their well-nourished, plump appearance, in contradistinction to leaf or wood buds, which are flattened, and which often lie flat along the wood. Fruit spurs are the prolongations of fruit buds, often branching into various buds with age. Laterals are the weak, twiggy growths which, in their second and subsequent years, generally produce fruit buds along their course. Strong growing, as well as upright, laterals must always be suppressed, cutting them back to a few basal buds, or removing them altogether. Vertical growths of any description should always be discouraged in fruit trees, as such upright growths induce a free rush of sap. the sap thus strengthening them, and depriving the lower and other parts of the tree of their legitimate nourishment. Slow sap movement always results in fruit production. and this can be attained by (*a*) sloping the whole framework of leaders out at a fair angle, and (*b*) suppressing or changing the direction of growth of any strong, upright growths, whether laterals or leaders.

In the management of the lateral system, it is generally advisable not to interfere with these unless they become too strong, when they may be treated as previously advised. Should they become too long, thus unduly interfering with each other, they may be shortened back, but always to a sub-lateral growth, which often occurs at right angles to the parent, or to a fruit bud lower down. To cut to a leaf bud merely induces a continuance of growth, with a consequent reduction of fruiting strength.

These remarks refer mainly to apple, pear, and plum trees; and, in the case of the first two varieties of fruit, it is generally advisable not to interfere with the laterals until they have formed their fruit spurs. A too thick or numerous lateral system may always be thinned out, but it must be remembered that once a lateral is removed entirely, it is very difficult to replace it, and impossible in some varieties of fruits. For peaches and apricots, it is always advisable to shorten back, and to continue to shorten back annually, all fruiting wood, as these trees produce their fruit on the new wood, and once the wood

has carried fruit, its work is done, and it may be removed. Where an apricot or peach tree produces laterals carrying no fruit spurs, these may be cut right off, as basal buds are generally present to produce fresh lateral growth. Only in the case of early fruiting varieties may these growths be retained, as they will in all probability produce fruit spurs late in the season.

Vegetable Garden.

Asparagus beds should be well cleaned out, and as soon as any young seedlings appear they must be culled out and thrown away. The work of digging the beds should be continued, digging in manure that was previously spread on the surface. Any seedling vegetables may be planted out; and the seeds of various sorts, such as peas, broad beans, carrot, leek, lettuce, spinach, radish, &c., should be sown. Asparagus crowns, rhubarb roots, and tubers of Jerusalem artichokes may be planted out.

Flower Garden.

Digging in the garden should be continued. Before digging, the beds should be given a top dressing of lime or of stable manure, and subsequently these could be dug well into the soil. Care must be taken not to injure the roots of any shrubs, trees, or roses. Root cutting and root pruning will always dwarf any plant. In digging, it is not wise to discard any leaves, twiggy growths, or weeds. Unless they are required for the compost heap, they should always be dug into the soil. Leafmould is especially useful in any garden, and where such plants as Azaleas, Rhododendrons, Liliums, &c., are grown, or for pot-plant work, it is exceedingly valuable. In forming the compost heap, no medium whatever should be added to help the rotting down of the leaves, unless it be a little sand. Any chemical added will render the mould unsuitable for its special objects.

Any hardy annuals may be planted out, such as stocks, pansies, wallflowers, &c., and cuttings of roses and hard-wooded shrubs may also be planted.

After flowering in the autumn and winter, shrubs, including roses, may be well thinned out and pruned, especially removing any weak, upright, or old flowering growths; keep the shrub always at an outward growth, inclining it to a broad bushy type instead of to an upright habit. By this means, the lower regions will always be furnished with good growth. Shrubs and trees of all descriptions should never be allowed to become too crowded; they require to be opened, so as to allow sunlight and air into the interior, where it is most needed. This is one means by which this class of plants may be kept healthy and free from disease. Very few shrubs resent pruning, and the majority of them, including Australian shrubs, such as Acacias, are very amenable to the pruning knife.

In rose pruning, the rule is that strong-growing plants require less severe cutting than weak-growing ones. As roses always flower on new wood, it is essential that to have good blooms, the bushes must be pruned regularly. All weak growths, exhausted and worn-out wood, must be removed, retaining only the vigorous growths. It is generally advisable to prune to four or five eyes or buds, so as to have subsequent strong growths, always pruning into the previous

season's wood. Spindly growths, especially in the centres of the bushes, should be removed, the plants being trained with an open and angular habit.

REMINDERS FOR AUGUST.

LIVE STOCK.

HORSES.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley.

CATTLE.—Cows, if not housed, should be rugged. Rugs should be removed in the day-time when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Calves should be kept in warm, dry shed. Those on the bucket should be given their milk warm. The bull may now run with the cows.

PIGS.—Supply plenty of bedding in warm, well-ventilated styes. Keep styes clean and dry, and the feeding troughs clean and wholesome. Store pigs should be placed in fattening styes. Sows in fine weather should be given a grass run

SHEEP.—Ascertain rams required for coming season and apply to breeders this month. Arrange for any merino or crossbred ewes needed for next lambing season direct from station if possible. Cull stud breeding ewes carefully, and enter only the very best young ewes. Where possible market any lambs ready and avoid the rush later on.

POULTRY.—When yards become damp and difficult to clean they should be sprinkled with lime and then turned over with a spade or fork. Keep the breeders busy—straw litter with a little grain scattered about will make them exercise. As the hen eats twice as quickly as the male bird, feed the latter by himself; tack a piece of wire netting on a light frame, and place it across an angle to make a small enclosure for him whilst he is eating. Overhaul incubators; see that the capsule or thermostat acts properly; thoroughly clean lamps, egg drawers, and chimneys Test machine for two days before putting valuable eggs in. It is also advisable to have thermometer tested. When additional incubators are required, it is more satisfactory to keep to the one make.

CULTIVATION.

FARM.—Second fallow where necessary for summer crops. If required, roll or harrow crops Plant very early potatoes in forward districts. Sow mangolds. Apply slow-acting fertilizers, such as blood and bone manures, for maize.

ORCHARD.—Complete planting and pruning of deciduous trees. Watch for peach aphis, and spray with tobacco solution, if present. Prepare for planting citrus trees. Spray for woolly aphis with strong tobacco solution.

FLOWER GARDEN.—Finish digging and pruning of roses, &c. Leave pruning of shrubs till after flowering. Keep weeds in check; weed out seed beds. Divide and plant out all herbaceous plants, such as phlox, delphiniums, rudbeckia, &c. Plant out gladioli. Complete planting of shrubs. Mulch young plants.

VEGETABLE GARDEN.—Top-dress asparagus beds; plant new asparagus plots. Plant herb divisions, and potatoes. Sow cabbage, cauliflower, peas, carrots, beans, radish, and lettuce seeds. Sow tomato seeds in a hot frame. Finish digging.

VINEYARD.—August is the best month for planting vines (grafted or ungrafted). This should be actively proceeded with and completed before end of month. Scions for field grafting may still be preserved as detailed last month, or better still by placing them in cool storage. They should all be removed from vines before end of month, at latest. Conclude pruning and tie down rods. Where black spot has been very prevalent, apply 1st acid iron sulphate treatment (see *Journal* for July, 1911). Apply readily soluble nitrogenous manures (soda nitrate or ammonium sulphate) during this month.

Cellar.—Rack again, towards end of month, wines which have as yet only been once racked (spring racking). Fill up regularly all unfortified wines. Clean up ...ally in cellar and whitewash walls, woodwork, &c.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 8. 11th August, 1913.

RECENT DEVELOPMENTS IN WINE-MAKING METHODS.*

By F. de Castella, Government Viticulturist, and W. Percy Wilkinson, Commonwealth Analyst.

Wine-making is, without a doubt, one of the oldest of the manufacturing arts concerned in the conversion of raw agricultural produce into a highly-finished food substance. As old, perhaps, as the ceramic art which, in the dawn of civilization, found so large a field for its activity in supplying wine-containing vessels.

Notwithstanding this great antiquity, it has, curiously enough, been one of the slowest to avail itself of the discoveries of modern science, the practical application of which, during the latter part of the last century more particularly, has wrought so vast a revolution in every branch of human activity as to make even passing mention of the fact here superfluous.

It is true that in this respect, wine-making shares in a defect common to most industries directly connected with the soil; for scientific methods have ever been slower in commending themselves to agriculturists or to those interested in the treatment of agricultural produce than to manufacturers, properly so called.

Even amongst agricultural industries, however, wine-making may truly be said to be the " Cinderella " of the family in the way of shyness to adopt improvements of any kind. The sister brewing industry, for example, so similar in many respects, has long since adopted, with the happiest possible results, methods similar to those which have only recently found their way into the most progressive œnological centres of Europe.

Dairying, which includes butter and cheese making, another fermentation industry, has long since adopted the modern methods which have led to its recent remarkable expansion.

* Paper read at the Melbourne meeting (1913) of the Australasian Association for the Advancement of Science.

In wine-making, though it has come tardily, the great change has nevertheless come at last, and it has come to stay; it is the object of the present note to briefly outline the more recent wine-making developments and to show what bearing their general adoption is likely to have on wine production in Australia. A brief glance at the state of the art of wine-making in Europe towards the close of the last century may here be permitted.

For several centuries at least, wines of the very highest quality have been produced. Quality in wine has a totally different signification from what it has in the case of other food substances, such as flour, sugar, butter, and even beer. In these, quality is largely a matter of freedom from defects, and once a certain standard is reached, little more is possible. For a wine to attain a really high standard of excellence, freedom from defects is, of course, an absolute necessity, but far more is required; a *grand vin* may truly be described as a work of art, and as such it can only be judged by certain more or less conventional standards. Thus we may find two wines of similar type, both free from defects, and yet one may be worth several times as much as another. *Grand vins* have been produced, in occasional vintages it is true, for hundreds of years in several favoured European districts. It is indeed safe to say that as good wines have been produced in the past as will ever be produced again, and this entirely by means of empirical methods carried out by cellarmen quite ignorant of science.

A parallel is to be found in pictorial art. Notwithstanding the advances of technical knowledge, nothing finer has been produced than the masterpieces of Raphael, painted nearly 400 years ago. Likewise with wine; what could be better than a Chateau Margaux '64, a Chateau Lafite '69, or a Chateau Latour '70? They are the perfection of their type, and nothing could improve them in any way.

The very perfection of such wines is largely responsible for the tardy adoption of scientific methods by European wine-makers. Owners of the vineyards which produced *grand vins,* naturally jealous of their reputation, feared any change. Their prejudice spread to their customers and to the wine-makers of less favoured regions, where improvement was often urgently required and where the adoption of scientific methods has recently transformed the wines produced.

Owing largely to this attitude, scientific enlightenment has had to fight its way inch by inch against conservative prejudice.

It must also be remembered that wine-making is vastly different from brewing or distilling. Nature serves up the juice of the grape, complete in itself and ready for fermentation; she even goes so far as to place the yeast required for the transformation, on the outside of the berry. All that is necessary is to crush the grape, the wine practically makes itself. Given perfect grapes in a district where suitable physical conditions prevail during the fermentation season, a good wine is almost sure to result, provided the wine-maker attends to cleanliness and follows the process which centuries of practice have sanctioned in his district. It is worthy of note that even in localities producing similar types of wines, and of equal quality, the procedure concerning several important points may vary very considerably.

Take Bordeaux and Burgundy, for example; in the former the grapes are entirely separated from the stalks and the wine is allowed to remain on the skins in closed vats for three or four weeks. In the latter, most of the stalks are mixed with the crushed grapes in the vat, where the fermentation only lasts about a week.

The above applies to those favoured regions where the composition of the grapes is perfect and where vintage weather conditions are suitable. In less favoured districts it has long since been found necessary to employ some artificial aid in the shape of a check to faulty fermentation. Thus do we find certain practices which have from time immemorial been carried out in certain districts, and which permitted the making of sound wine where this would have been otherwise impossible or very difficult. In choice districts, such as Bordeaux and Burgundy, the danger of faulty fermentation is small, owing to the relatively high acidity of the grapes; further security is afforded by the cool weather prevailing during vintage. In warmer regions difficulties have to be faced such as are unknown in the cooler districts, save in rare abnormal seasons, and, in order to combat them, additions of one sort or another have long been in vogue.

Hops have been used in brewing for so very long that we now always associate the flavour of this aromatic plant with beer. The real reason for its use is not, however, to be found in its flavour, but in its greater inhibitory action on the development of undesirable micro-organisms than on the true yeast. With the aid of the hop, a sound beer could be obtained; without it, a faulty product was almost inevitable. The hop plays a similar part in brewing to that which the natural acid of the grape does in wine-making, it is a selective antiseptic which renders the fermenting medium less suitable for the growth of bacteria than of yeast.

In countries where fermentation troubles were frequent, the addition of a substance capable of exerting an action similar to that of the hop in brewing has, from very early times, been a regular wine-making practice.

The resinous wines, still so much in favour in Greece, and which were so largely manufactured in ancient Rome, are in this connexion most interesting.

The semi-plastic, whitish exudation of the Aleppo Pine (*Pinus Halepensis*) is the form of resin used; it is added to the must before fermentation at the rate of 40 or 50 lbs. to the 100 gallons. It is previously worked into a thin paste with a little must, a small quantity of spirit being sometimes added to facilitate extraction.

Fermentation is slower in resined than in non-resined wines, and they are sounder and better protected against secondary fermentations. These wines are very largely made on the Greek mainland. According to M. Panayotis Pyrlas,* one of the delegates sent by the Greek Government to the Montpellier Viticultural Congress of 1911, they are much appreciated by Greeks and, as M. Pyrlas rather naively adds, even by foreigners, who, after a time, become accustomed to the resinous taste. They are consumed young, for they become bitter on keeping, owing to chemical changes taking place in some of the sub-

* *Progrès Agricole*, 12th March, 1911.

stances extracted. The resin in these curious wines plays the same part that the hop does in brewing.

Plastering is another warm country addition, with a similar object. This interesting process has never become popular in Australia, a fact on which, in the light of recent events, we may congratulate ourselves, but which is none the less curious, seeing that so many of our wine-making pioneers were recruited from parts of Southern Europe, where the practice has been so long current. In the warm countries bordering on the Mediterranean, plastering of wine has been common, at any rate, since the time of Pliny; it appears probable that in many of these it displaced the use of resin, the more cultivated western palate no doubt preferring a wine free from this foreign taste.

The object of plastering is the same as the addition of resin, namely, to make a sound wine in spite of fermentation difficulties. The process is simple; it consists in the addition to the grapes, when they are being crushed, of powdered gypsum or sulphate of calcium, either burnt or raw, at the rate of a few pounds to the ton of grapes.

The beneficial effect on fermentation, the mechanism of which was certainly not understood until recently, is mainly due to an increase in the proportion of tartaric acid in the must, at the expense of the cream of tartar, which, especially in over-ripe grapes, often prone to faulty fermentation, is so abundant that a considerable undissolved, crystalline excess, over and above what the juice is capable of holding in solution, is always present. A further beneficial action is to be found in the precipitation of certain albuminous matters, an excess of which is not uncommon in the grapes of warm climates. An improvement is also effected in the colour, which is rendered more brilliant, and the condition, which becomes more stable.

The action of sulphate of calcium on potassium bi-tartrate is explained by the following formula:—

$$2(KHC_4H_4O_6) + CaSO_4 = CaC_4H_4O_6 + K_2SO_4 + C_4H_6O_6$$

It follows that, in addition to the tartrate of lime, which, being insoluble, is eliminated in the lees, sulphate of potash is also formed. This salt, being soluble, remains in the wine, and though a normal constituent of all wines, it was the increase in this substance to a point which French hygienists considered excessive that led to the suppression of plastering. It is true that plastering somewhat modifies the flavour of the wine—Kulisch* has shown that as little as 0.02 gramme of potassium sulphate is sufficient to distinctly affect and impart a harsh character to the taste of wine. After lengthy investigation, the French Academy of Medicine decided, in 1891, that wines containing more than 2 grammes per litre of sulphate of potash were unwholesome for every-day use. Legislation was passed limiting the legal percentage of sulphate of potash to the above figure. Used in the reduced quantity required by the new law, the controlling effect on fermentation was so much reduced as to be of little service; plastering has in consequence fallen into disuse, at least in France, and those numerous countries whose pure wine legislation is based on French ideas. It is worthy of note that Sherry, one of the world's finest wines, is usually plastered to about twice the extent tolerated by

* *Weinlaube*; 44; 1899.

French law. The use of plaster seems indeed to be necessary in order to obtain the maximum of quality and character in this unique type of wine. Hygienists may well be expected to tolerate this slight excess; it is scarcely logical to fix the same sulphate limit for a special wine, of which an occasional glass is taken, as for a *vin ordinaire*, consumed in quantity.

Much perturbation was caused in Southern France by the suppression of plastering, and much inferior wine was made during the vintages which immediately followed it; in fact, until new methods, based on scientific research, came to the rescue. These proved far more potent for good than the old empirical methods, and though, for a few years, the giving up of the plaster which had for centuries regulated fermentation was looked upon as a serious and unnecessary hardship, it is now no longer regretted, and the quality standard of even the cheapest *vins ordinaires* is higher and more uniform than ever it was before.

The methods which superseded plastering were not, however, the first application of science in the domain of the wine-maker, and, if a logical sequence is to be observed, these must be held over for the present.

The above retrospect will serve to illustrate what has already been stated, viz., that in certain favoured regions the wine practically makes itself, the grapes and the factors governing their conversion into wine being all that could be desired; but that as regards the great majority of wines, especially in warm climates similar to ours, conditions are seldom perfect. Rectification of nature's shortcomings has long been found necessary, and it is by replacing such empirical corrections as the use of resin or plaster by more logical and far more efficient ones, that science has transformed the vintner's art, with truly remarkable results, in the direction of soundness and uniformity.

The aid of science was first sought in connexion with the correction of the composition of faulty musts, chiefly of those from immature grapes, by the addition of sugar; a simple specific gravity observation, indicating with sufficient approximation for practical purposes, the sugar strength of the must and the addition required. This and similar simple modifications are mentioned in the works of wine-making authorities published in the fifties and sixties of last century, except among few of the more progressive growers such teachings only very gradually found application in general wine-making practice.

Unscrupulous persons were more prompt to avail themselves of the advance of knowledge than honest wine-growers. Sophistications such as the stretching of the natural grape juice with sugar and water, were indulged in to such an extent that for a long time the very name of chemistry became objectionable in wine trade circles, in which it was looked upon as being more or less synonymous with fraud.

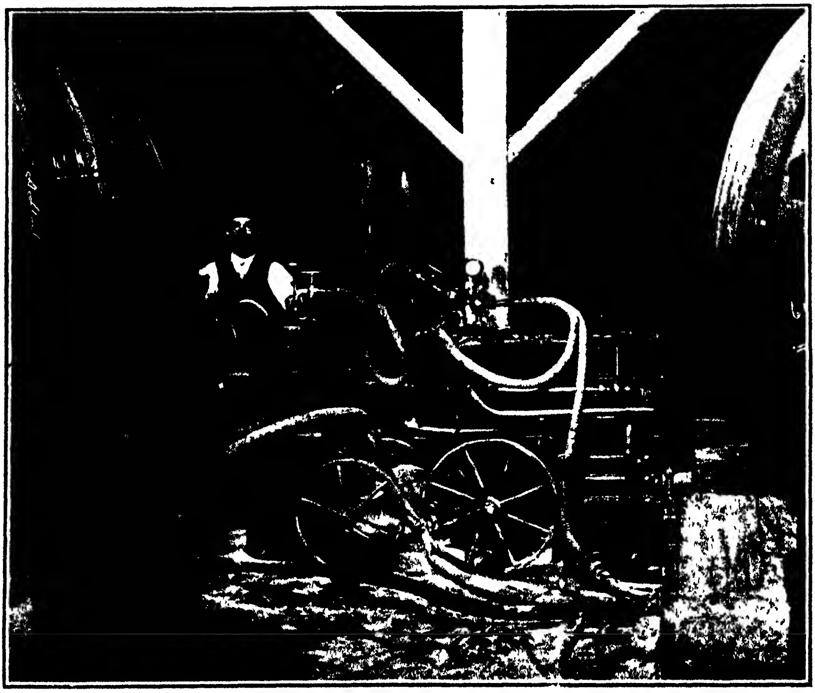
Pure wine legislation came to the rescue, sternly suppressing reprehensible manipulations, and thus entirely rehabilitating the application of science to œnology.

One of the earlier beneficial results of the teachings of chemistry was the use of tannin in Champagne making. This wine, which is largely made from red grapes, had to be very lightly pressed, if colour extraction was to be avoided, hence tannin deficiency, which entailed

insufficient precipitation of albuminous matters, and even viscous or "ropy" fermentation—in short, faulty wine. Chemists traced these evils to their true cause, and the logical use of tannin, which has ever since been one of the characteristic features of Champagne making, certainly ranks among the earliest practical applications of science in wine-making. The use of tannin spread to other wine districts until to-day this substance may be looked upon as an indispensable auxiliary in every cellar.

PASTEURIZATION.

To Pasteur is due the credit of having explained and perfected, rather than of having invented the method of preserving wine from



PASTEURIZING WINE IN A VICTORIAN CELLAR.

subsequent deterioration, which to-day bears his name. We may here recall the experiments of Spallanzani on meat extract in 1765, of Scheele on vinegar in 1782, and of Appert on food substances generally in 1810. Gervais, in 1827, and Vergnette-Lamotte, in 1840, extended the process to the preservation of wine; but their recommendations were not given effect to. Long before this, however, as early as the end of the 17th century, a process practically identical with pasteurization was generally used in Japan for the preservation of Sake, which could not previously be kept in drinkable condition through the summer months. Preservation by means of preliminary heating, an accidental discovery, proved a solution of the difficulty.*

* Dr. T. Takahashi, Professor at Tokio Imperial University. Article on the Brewing Industry in *Industrial Japan* 1912

Pasteur was the first to explain that the deterioration to which wine is liable is caused by certain organisms, which in an acid and alcoholic medium such as wine are easily killed by brief exposure to a temperature of 60 degrees C. Pasteur took out a patent for the treatment of wine by heat in 1865, but generously allowed it to lapse. His classic work *Etudes sur le vin*, published in 1866,† describes several wine-sterlizing machines, rude, it is true, but the prototypes of the far more efficient appliances now obtainable. During the heating of the wine, contact with air must be guarded against, if modification of taste is to be avoided. This was the chief difficulty in earlier machines, but it has been overcome by improved construction. Nevertheless, a prejudice arose which is responsible, in a large measure, for the reluctance which still exists in some quarters, to adopt this most effective treatment. Professor Gayon, of Bordeaux, continued Pasteur's work. He has conducted investigations which have abundantly proved the advantages of pasteurization, and that, if properly carried out, the process cannot injuriously affect even the most delicate wines. His experiments were mainly conducted with bottled wines, and so far as these are concerned there can no longer be any doubt as to the efficacy of the process and the complete absence of any undesirable change in the wine treated.

Pasteurization in bulk has not proved quite so generally effective or satisfactory When employed in an ordinary cellar, reinfection during the usual routine manipulations, is apt to defeat the object of the treatment. Some practical wine-makers take up the position that prevention is better than cure, and that the use of modern methods such as can render the medium more suitable for the development of desirable than of undesirable organisms, both during and after fermentation, renders pasteurization unnecessary; this is, in fact, what actually occurs in vineyards producing wines of highest grade in good seasons.

In spite of the marked improvements in the construction of wine-sterilizing machines, especially during the past twenty years, their use is by no means so general as might be expected. The process has not become as was anticipated in Pasteur's time, a current cellar treatment, necessitating the presence of a pasteurizer as an indispensable part of the equipment of every cellar. These machines are, nevertheless, a most valuable adjunct, capable of saving many a wine which would otherwise become unmarketable; and, though they are not usually to be found in smaller cellars where operations are limited to the treatment of the produce of the vineyard, they are gradually forcing themselves into all European establishments where wine is handled on an extensive scale. In Australian wineries far more attention could, with advantage, be paid to the question than it at present receives, especially by our wine shippers, as was pointed out by one of us twelve years ago.

Though the adoption of pasteurization has been slow, even in Europe, it is nevertheless progressing steadily, and it certainly ranks as one of the most important scientific developments in wine-making.

† It is in the second edition of this work, published in 1872, that much space is devoted to wine sterilization by heat

DISEASES OF WINE.

Pasteurization leads logically to the consideration of the organisms causing disease, the destruction of which is the object of the treatment. Following on the pioneer work of Pasteur, and more particularly in recent years, the diseases of wine have been extensively investigated, much attention being devoted to those caused by anaerobic organisms, far more dangerous and difficult to guard against than aerobic ones, against which the ordinary rules of good cellar management, such as cleanliness and frequent filling of casks, provide adequate protection.

Anaerobic diseases, the ones mainly to be feared in warm climates, present considerable interest in Australia; the importance their study has recently acquired in the Old World is in part due to the withdrawal of the protection afforded by plastering, when its suppression was decided on in 1891, but even in greater measure to the vast extension of Algerian wine production. Here fermentation problems, mainly connected with low acidities and high temperatures, presented themselves in a more acute form than on the northern shores of the Mediterranean. The climates of Northern Victoria and Algeria being so similar, the knowledge gained in the latter country is of very real value to us. Improvement in the average quality of Australian wine which is so marked a feature of the industry to-day is mainly due to the application of recent teachings of French and Algerian œnologists, our indebtedness to whom must here be gratefully put on record.

A remarkable feature in connexion with wine diseases of the anaerobic class is the difficulty which has been experienced in the way of isolating a special organism, responsible for a given, well-characterized disease. Scud, or *tourne*, the closely allied *pousse*, the bitter disease of Burgundy, and ropiness, or *graisse*, are quite distinct in the modifications they cause in the taste of the wine, yet the organisms responsible for them all induce mannitic fermentation when placed in a solution containing levulose, such as the juice of the grape. As Bouffard pointed out at the 1911 Montpellier Congress, these different diseases appear to be caused by closely connected, if not identical, germs—the different changes of the wine depending rather on the initial composition of the liquid. The same microbe in different wines would bring about different changes.

The intricacy of the question and the incomplete state of our knowledge concerning it can only be mentioned here. So far as the practical wine-maker is concerned, he will do well to remember, in a general way, that all micro-organisms, other than yeast, are potentially dangerous. In the picturesque words of Bouffard,* so far as the vine-grower is concerned, "The fear of microbes is the beginning of wisdom." Let him guard against their appearance by rendering the medium as unsuitable as possible for their growth by such means as we shall consider presently, and destroy them by pasteurization should they develop. Such is the mandate of science to the wine-maker.

Reference must also be made to the diseases known in France under the collective name of *casse*, so called from the breaking up of the colouring matter. This modification is brought about by an

* *Congrès Viticole de Montpellier*, 1911.

enzyme termed Oxydase, more especially plentiful in grapes damaged by moulds. Sulphurous acid proved of great service in combating *casse.* It was its experimental use in this connexion which led to the evolution of the wine-making method known as sulphiting.

PURE YEASTS, OR "LEVURES."

The substitution of pure cultures of selected yeasts for natural yeast, present at vintage time on the skin of the grape, being the ultimate outcome of Pasteur's epoch-making investigations, may be considered next, in spite of the fact that its general adoption is only now beginning to make itself felt as a regular wine-making method.

Many years have elapsed since the art of the brewer was revolutionized by the application of the technically simple methods first advocated by Pasteur, and perfected by his successors Hansen, Wörtmann, and Jorgensen. The application of similar methods in the sister art of wine-making was only a matter of time, and rather more than twenty years ago the propagation and trade in selected wine yeasts was, for a time, a profitable industry in France. Those interested in the sale of such cultures claimed that their use would transform wine-making, permitting the production of the choicest wines from good ordinary must, provided the appropriate yeast were employed. As was inevitable, these extravagant hopes were disappointed, with the regrettable result that selected yeasts were discredited and their use almost abandoned for many years.

In scientific circles they continued to receive attention. Thanks to the investigations of Kayser, Rosentiehl, Fernbach, Martinand, Jacquemin, and others, the causes of earlier non-success were explained, and the use of pure yeasts was at length placed on a sound basis. Progress, though slow at first, was none the less sure. From the laboratory the new method gradually spread until, to-day, "Levured" wines are made in France by millions of gallons.

The difficulty experienced in supplanting the native yeast by the pure culture was the main reason for the non-success of early experiments; in the greater majority of these the added yeast can have taken little or no part in the fermentation. Preliminary sterilization by heating, though it gave encouraging results, was not practical on a large scale, and it is mainly due to the general extension of "sulphiting," a process which will be considered presently, that full advantage can now be taken of the use of pure yeasts in wine-making.

Though the advantages gained fall far short of early expectations, they are none the less considerable. They may be briefly resumed as follows:—Increase in alcohol production, due mainly to the absence of sugar waste by wild yeasts. Improved "condition" of the resulting wine owing to more rapid and complete yeast precipitation. Resistance to adverse conditions, such as high temperature, a large percentage of tannin or of alcohol in the case of high gravity musts. Even as regards production of bouquet, an improvement is generally admitted.

The progress already achieved in the use of pure yeasts constitutes a distinct œnological advance, though there are still problems to be solved, such, for example, as the suiting of the yeast to the grapes one has to deal with, a point apparently of importance in connexion with the production of bouquet. It is also reasonable to ask, in view of

the variety of organisms present in natural fermentations, whether symbiosis may not play a part in fermentation.

TEMPERATURE CONTROL DURING FERMENTATION.

In this, perhaps, we have the most important modern development, especially as regards the making of wine in warm climates. It has long been known that the quality of the wine suffers if the temperature, during fermentation, exceeds a certain point. In cooler wine regions, such as those of Central France, dangerous temperatures are rarely, if ever, experienced, hence the small amount of attention the question has received until recently. It is, indeed, the spread of vine-growing in Algeria to which we are mainly indebted for the attention the question has recently received. It is worthy of note, however, that the late Dr. A. C. Kelly, the well-known South Australian vine-grower, in his work *The Vine in Australia,* published in 1841, devoted considerable attention to temperature control during fermentation. He, in fact, describes a refrigerator which he had actually employed, but the use of which was afterwards discarded, owing to the fear that the metal of which it was constructed might injuriously influence the wine. Dr. Kelly's remarks, especially in view of more recent developments, are exceedingly interesting. There can be no doubt that had his teaching received more attention at the time, Australian viticulture would have benefited to an enormous extent.

The optimum temperature for yeast, or that at which it shows its maximum of activity in the direction of sugar transformation, appears to be between 30 and 35* degrees centigrade. A temperature curiously close to that at which it begins to suffer, 38 degrees being looked upon as the point beyond which yeast undergoes deterioration. In practice it has been found necessary to keep considerably below the optimum temperature, at least in the early stages. Fermentation is an exothermic reaction liberating a considerable amount of heat; the exact amount does not seem to be accurately known. The most recent researches on the subject appear to be those of Bouffard,† who by direct experiment found that 180 grammes of sugar dissolved in a litre of water was capable, during fermentation, of liberating 23.5 calories. This is appreciably less than the 32.07 calories given by calculation. The actual amount of heat released will probably be found somewhere between these limits. The temperature of the fermenting mass must increase unless this heat be removed, either artificially or by natural radiation, as actually occurs in cool climates; otherwise it accumulates until temperatures fatal to yeast are reached, with disastrous results to the constitution of the wine. Not only is the yeast killed by the elevation of the temperature, but even before this occurs, owing to life under unfavorable conditions, it behaves differently from what it does in normal growth, and excretes substances injurious to its further healthy development, even if temperatures are subsequently lowered. Wine produced at high temperatures contains a larger proportion of volatile acidity, and also retains albuminous substances in abnormal quantity, with the result that it not only clears with greater difficulty, but is more suitable for the

* 86° and 95° Fahrenheit.

† *Comptes Rendus de L'Academie des Sciences*, Paris, 12 Aout, 1895.

life of injurious organisms, such as bacteria. Temperatures dangerous to yeast are also eminently suited to the development of injurious bacteria. Thus fermentation at high temperatures not only directly encourages the invasion of the wine by disease organisms during the time the temperature is excessive, but also by supplying food for their ulterior development. One of the most dreaded disease organisms is the mannitic ferment, which produces mannite at the expense of levulose. Mannite, though an unfermentable sugar, is a very suitable food for many disease organisms. As we have already seen, there is every reason to believe that the mannitic ferment itself is capable of bringing about ulterior changes of varying kinds. The complicated mechanism by which high fermentation temperatures injuriously affect the wine cannot be fully gone into here.

Different methods of refrigeration have been recommended. Our Northern vine-growers generally use tinned-copper coils through which cold water circulates, after the style of the attemperators which have so long been used in breweries. In Algeria, exterior coolers of the Lawrence type are favoured, the wine being withdrawn from the vat and returned to it after having been pumped through the cooler. It will suffice here to say that temperature correction has absolutely transformed the wines of the hot countries where it has been applied.

Semichon* describes how Algeria, "which formerly produced wine with such a bad name, now produces perfect wines; even preferred by the trade to many French wines. Scarcely ten years ago, when one detected in a blend the sour-sweet taste, which we know to be caused by fermentation at high temperatures, it was invariably agreed that it had an Algerian taste!"

The substitution of cement fermenting vats for the wooden ones formerly used has done much to reduce temperature troubles. Being a better conductor, heat is more readily lost through radiation and conductivity, especially at night time. These, as well as stone vats, which present similar advantages, have long been used in the warm wine-making countries of Europe, such as Spain and Portugal. Their introduction into the cellars of Northern Victoria, which took place over twenty years ago, was immediately followed by a marked improvement in the quality of the wines made, an improvement which was considerably accentuated when, a few years later, temperature control became general. The transformation of Australian wines has been quite as striking as that described by Semichon in Algeria, and it is this improvement which has mainly contributed to the development of our now extensive export trade in wine to England. It is a noteworthy fact that, whereas the imports of all other wines into the Mother Country have generally declined during the past twenty years, those of Australia alone show an increase.

SUBSTITUTES FOR PLASTERING.

We have already seen that the suppression of plastering created a certain amount of consternation in the countries where its benefits had long been taken advantage of, hence the introduction of several substitutes, one of which—the use of bi-calcic phosphate—was somewhat largely practised. The addition of this salt to the crushed

* *Semichon, Traité des Maladies des Vins.*

grapes brings about a somewhat similar reaction to that of plastering. The acidity is increased, and phosphate, instead of sulphate of potash, becomes present in the wine. Phosphate not being open to the same objections, its presence was permitted by pure wine legislation. The process still has partisans, though it has been rendered unnecessary by several more desirable methods, notably sulphiting, which will be shortly referred to. Several other substitutes were also tried with varying success.

In the correction of acidity, however, we find by far the most logical substitute for plastering; in the case of warm-climate grapes, so often deficient in natural acidity, it is most strongly to be recommended. Seeing that plastering acts by releasing tartaric acid, it was only logical to add this substance directly to the must. Such

A WINE SHOP—A.D. 79.

A "Cantina" in Pompeii—The circular apertures in the marble counter served to hold the pointed ends of the earthenware *amphorae* from which the wine was served to customers.

direct addition is, of course, completely under the control of the wine-maker. The same results may be obtained by other methods, such as the blending in of a proportion of unripe grapes, or the picking of the main crop somewhat earlier, and before the acidity has fallen to too low a point. These methods, though useful, are not always quite suitable in Australian cellars, especially for the making of the full-bodied export wines demanded of us in London and in order to make which, considerable maturity of the fruit is indispensable. That the acidity of Australian grapes is often low was pointed out by one of us in the paper read at the Adelaide meeting of the Australasian Association for the Advancement of Science in 1893.

Fermentation troubles arising from insufficient acidity lead to the seeming contradiction that, within certain limits, the less acid the

grapes, the more acid the resulting wine. The acids which develop during and after fermentation belong to a totally distinct class from those naturally present in the grapes. They are characteristic of unsoundness in wine, and their presence in appreciable quantity renders it not only undrinkable, but unfit for conversion into brandy, or even good vinegar.

YEAST STIMULATION.

In addition to its carbo-hydrate food, yeast, like other plants, requires nitrogen and mineral substances. The artificial increase of these, which may be compared to the manuring of higher plants, has proved a valuable means of aiding fermentation. Potash is, of course, abundantly present in the shape of cream of tartar, but nitrogen and phosphoric acid are much less plentiful. Unlike higher plants, yeast readily assimilates ammoniacal nitrogen, but it cannot absorb nitrates. Phosphate of ammonia is thus indicated for the purpose. Its use has proved most beneficial as a stimulant to fermentation. In Australia, such yeast stimulation assumes even greater interest, especially for the production of wine of the export type where fermentation has to be pushed to a degree unknown in Europe. The results obtained. so far, have been most striking.

SULPHITING.

By this term is understood the addition of sulphurous acid to the must during fermentation as a means of regularizing and controlling it. The use of sulphurous acid in wine cellars dates from antiquity, and it is, at the present time, the only antiseptic permitted in wine. For this purpose its addition was generally made subsequently to fermentation. In the later nineties of last century several experimentalists, among whom may be mentioned Rocques, Müller-Thurgau, Andrieu, Dupont, Ventre, and others, tried the influence of this antiseptic *during* fermentation. The results were startling, and have gradually led to the evolution of a process which is undoubtedly the most striking wine-making development of modern times.

Sulphurous acid exerts its action mainly through its antiseptic influence on the different micro-organisms contained in the fermenting mass, which is more severely felt by injurious bacteria than by yeast. Even on yeast it exerts an important selective influence, hindering undesirable to a greater extent than useful types. Sulphiting has absolutely compensated the wine-growers of warm countries for the loss of plastering. Not only is it far more effectual, but it presents nothing contrary to Australian and European pure wine legislation, the sulphurous acid being a temporary antiseptic which disappears after having exerted its regularizing effect on fermentation.

Sulphiting also assists materially in the direction of temperature control. By retarding the early impetuous start of fermentation it increases the chances of natural loss of heat through radiation, where this is possible, and gives more time for the execution of refrigeration, if it must be resorted to. In this connexion its use may be looked upon as amounting to chemical cooling by retardation of the rate of fermentation.

Sulphurous acid may be added to the crushed grapes in several different forms. They may be made to absorb the gas resulting from

the combustion of sulphur. Sulphur dioxide may be added either in the liquefied form, in concentrated aqueous solutions, or in the combined state as bi-sulphite of potash. The latter is, perhaps, the most convenient form, and it is the one which has given the name to the process, but the direct introduction of liquefied sulphur dioxide now tends to displace it in France, being cheaper and, now that ingenious measuring devices are obtainable, just as convenient. The dose varies from 10 (ten) to 15 (fifteen) grammes of sulphur dioxide per hectolitre (1½ to 2¼ ozs. per 100 gallons).

During the past two years sulphiting has been strongly urged on Victorian vine-growers by one of us. It has been extensively applied with most gratifying results, and is firmly establishing itself as a regular wine-making method in Australia.

THE "VINERIE" SYSTEM

Is the logical outcome of sulphiting. Briefly described, it consists in the sterilizing of the grapes as soon as they are vintaged and crushed, with a sufficient dose of sulphurous acid to render fermentation impossible. They can then be stored until such time as suits the wine-maker, and fermented at leisure, after the removal of sulphurous acid by the operation known as de-sulphiting, under most suitable conditions as regards temperature and cellar care.

In the ordinary course of events, vintage is a time of stress and bustle, a time of emergency, hence often embarrassing for the carrying out of so delicate an operation as fermentation. The "Vinerie" system obviates all this, and puts wine-making on a somewhat similar footing to brewing. The crop is harvested as rapidly as may be desired, but its transformation into wine is carried out as deliberately and methodically as the manufacture of beer. The adoption of the "vinerie" system will undoubtedly lead to the industrialization of wine-making, the advantages of which in the direction of evenness of type, reduction in cost of handling, and several other ways are obvious. The credit for this latest innovation appears to be mainly due to Barbet, the well-known authority on distillery equipment. De-sulphiting, or removal of sulphurous acid, is performed in a column, analogous to the rectifying column of a still, in which the bubbling of air through the liquid, under reduced pressure and at a temperature of about 70 degrees C., is capable of removing practically the whole of the sulphurous acid. At the "vinerie" of Misserghin, in Algeria, where half a million gallons of wine were made last year by the new process, the de-sulphiting column is made of earthenware. So far as white wines are concerned, the process, as might be anticipated, has given most excellent results. In the case of red wines, there are yet problems to be solved. Some authorities prefer three or four days' maceration previous to pressing, during which colour and tannin are sufficiently extracted, sulphurous acid really acting as a solvent. Though it transforms the colour to such an extent that it is apparently destroyed, it reappears in a more intense form than ever on the elimination of the sulphurous acid. Other authorities separate the juice immediately and ferment it into white wine, with which they afterwards extract the colour from the preserved skins. Several important "vineries" have already been established in Europe and

Algeria. Although there may be a few minor problems yet to be worked out, results obtained have amply fulfilled expectations, and the method will undoubtedly be enormously extended within the next few years. One direction in which it shows great promise is for the manufacture of unfermented wine, a beverage which should find more favour than it does with those having conscientious prejudices against alcoholic liquors. Pure grape juice, though too sweet by itself, is, when diluted with water or sodawater, an agreeable, wholesome, and thirst-quenching drink, far preferable to the artificially flavoured and coloured cordials so extensively consumed.

CONCLUSION.

Enough has been said to show that wine-making at the present day is something entirely different from what it was a quarter of a century ago; more especially during the past few years very considerable progress has been made, and though there are yet problems awaiting solution, we can claim to have reached the stage when, thanks to the teachings of science, there is no longer any excuse for the making of unsound wines. Of course, the paramount influence of soil and situation will continue to make itself felt, and those vineyards which have long shown their natural superiority will, no doubt, continue to do so.

It will be noted that the *rôle* of science is to prevent, and not to cure, the various diseases to which wine is liable, and surely such progress is on the soundest lines. A faulty wine is almost valueless, and cannot by any treatment be made properly marketable. Science has taught the wine-maker how to make the best possible wines from the grapes at his disposal, even under adverse conditions.

The train of research initiated by such master minds as Pasteur and Liebig has borne abundant fruit. The innovations in wine-making practice which are its logical outcome have revolutionized the industry, which, even from so material a motive as self-preservation, is henceforth compelled to avail itself of the teachings of science.

A PRECOCIOUS CALF.

By R. T. Archer, Senior Dairy Inspector.

When visiting the farm of Mr. Wm. Kerr, "Leura," Camperdown, my attention was drawn to the remarkable udder development of a seven months' old black and white cross-bred calf three-quarters Jersey. On investigating the development, it was found that the calf was secreting apparently normal milk. The development had been noticed some time prior to my visit, and it is probable that the calf had milk at six months old or sooner. The accompanying photographs were taken at nine months old, when she was yielding 5 lbs. of apparently rich milk once daily on scant pasture in the middle of summer. One can reasonably assume that had she been well fed and milked twice daily the yield would have been much greater. We

know that a calf's start in life is no haphazard affair, but is rigorously determined by its ancestors for some generations. Each individual calf is the embodiment of the successes achieved by its ancestors. Such

being the case, the young heifer under review has every promise of being a splendid dairy animal, for her grand-dam is "Linda," winner of the butter test at the Camperdown Agricultural Show in

1907, yielding 45¼ lbs. of milk and 2.70 lbs. of butter daily, or at the rate of nearly 19 lbs. weekly. This cow was a Jersey-Ayrshire cross, and although having only three teats (the other teat was cut off

by barbed wire when a heifer), produced on home performances up to 56 lbs. of milk daily in the spring time. She was a consistent milker, and on one occasion milked right through the lactation period without a spell. Her dam, "Linda II." is a strawberry-coloured cow showing a little of the Ayrshire strain, and is of splendid dairy type. This cow generally calves in the autumn, and consequently does not make the high daily record that spring-calved cows do, but in May, 1910, her daily yield was 35 lbs., 5.2 test, being 2.11 lbs. butter, or nearly 15 lbs. weekly. She was still milking well when the calf's photo. was taken in January, nine months after birth. The heifer under review was sired by a pedigreed Jersey bull, the dam of whom won the Jersey Female Championship at the Grand National Show, Colac.

While maternity is the prime cause of secretion, it is not the only means of stimulating the activity of the udder. The regular removal of saline fluid in the gland of the virgin animal or even the stimulation of the organ by the sucking of a calf is sometimes sufficient to cause the secretion of milk of normal character in considerable quantities. The phenomenal udder development and the subsequent large milk flow of this young heifer were caused by the sucking of another calf. When this was noticed the calves were separated, but the amount of milk in the calf's udder necessitated milking it daily, with the result that the flow is increasing. The heifer is very well-grown, and shows no ill-effects of the continual milking. A sample of the milk has been collected and analyzed by the Chemist for Agriculture, and the table appended shows that the fat and milk sugar are present to a slightly greater extent than is usual. For purpose of comparison, the analysis of normal milk is also given:—

Report on analysis of sample of milk from Mr. Kerr's calf—

Total solids	15.10 per cent.
Ash	.65 "
Total proteids (N x 6.25)	3.39 "
Fat	6.00 "
Milk sugar	6.72 "

Normal cow's milk—

Total solids	13.0 per cent.
Ash	.75 "
Total proteids	3.5 "
Fat	4.0 "
Milk sugar	4.75 "

EFFECT OF FORMALIN AND BLUESTONE PICKLE ON THE GERMINATION OF WHEAT.

By C. C. Brittlebank, Vegetable Pathologist

The following experiment was undertaken with a view to ascertain the effect of time upon the germination of wheat after treatment with formalin and bluestone solutions:—Federation wheat of the previous

harvest was used throughout the test. A sufficient quantity was obtained and divided into three equal parts, one being set aside as a control and the other two parts being pickled, one in a solution of formalin, 1--300, for a period of five minutes, and the remaining portion in a 2 per cent. solution of bluestone for one minute. After pickling, the seed was thoroughly dried and placed in clean calico bags.

As it was important that the conditions during the germination of the control and pickled wheats should be comparable one with another, they were, as far as possible, carried out with this in view. The method adopted being as follows:—Sheets of white blotting paper were folded once along their length and then at right angles gathered into a number of pleats or folds, Fig. 1. One hundred grains each of the control and treated grains were then placed in the troughs of their respective papers, which were then placed in a shallow porcelain dish, into which water at 70° F. was poured until the papers were thoroughly soaked. The surplus water was then drained off, and the dish covered with sheet glass and allowed to remain at room temperatures. A period of twelve days was given for germination of the grain, but a shorter period would suffice, as the sound grains had sprouted and appeared above the folds of the paper within from seven to eight days.

From the first there was a marked difference in the vigour and growth of the plants. As might be expected, the control was the quickest to germinate, and the most vigorous and luxuriant in subsequent growth. Germination percentages being between 92 per cent. and 99 per cent. during the experiment, or an average for the 54 weeks of 95 per cent.

The next in germination and vigour was that pickled in formalin solution, which gave as the result of the test an average over the 54 weeks of 91 per cent. All through the test the seed treated with bluestone pickle could be detected, being greatly behind the control and formalin-treated seed—**Fig. II.**

In referring to the table, it will be noticed that the germination of seed treated with formalin solution fell off after the first week, and continued to do so to the end of the sixth week, after which there was a rise in the percentage of germination to the ninth week. When there was another fall, followed by various fluctuations in germination to the end of the fifty-fourth week.

The highest percentage of germination in the bluestone pickled wheat was 95 per cent. at the end of the first week, following which there was a more or less gradual fall, reaching 32 per cent. at the end of the experiment.

Table I shows the various fluctuations from the first week to the end of the fifty-fourth.

As it is not possible to arrive at conclusions from any single experiment, similar work will be carried on during the present year. The conclusion derived from the above experiment, is that seed should be sown as soon as possible after treatment, which is the practice adopted by growers generally.

Fig 1.

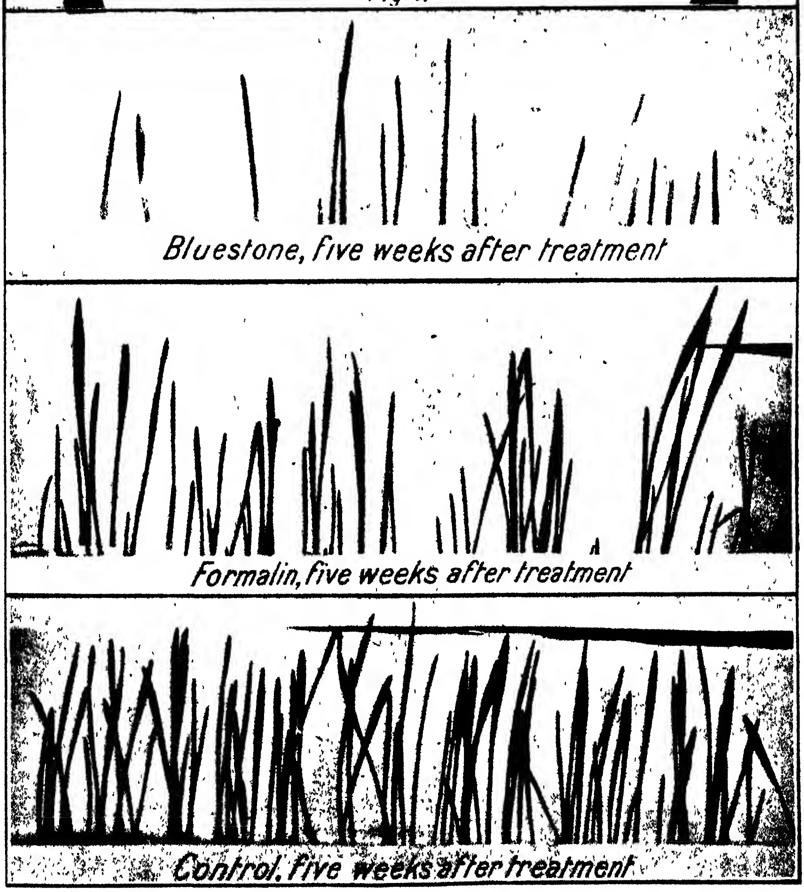

Bluestone, five weeks after treatment
Formalin, five weeks after treatment
Control, five weeks after treatment

Fig. 2.

TABLE I.

Number of Weeks after Treatment.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Control, per cent. germinating .	98	99	98	98	98	99	98	97	98	97	97	98	98	95	98	97	96	98	98	96	97	95	95	97	97	95	92	95	93	94
Bluestone, „ „ .	95	92	92	85	76	72	71	68	68	71	68	52	54	52	51	45	52	44	56	44	45	42	42	41	43	43	41	42	41	41
Formalin. „ „ ..	93	93	93	92	93	93	97	97	98	95	93	93	92	89	90	93	93	85	92	93	92	90	90	95	95	94	93	93	93	92

Number of Weeks after Treatment—*continued*

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Average total germination for 54 weeks—
Control, per cent. germinating ..	93	92	94	92	91	92	97	92	92	92	92	93	94	92	93	92	94	93	93	93	92	95	93	94	95 per cent.
Bluestone. „ „ ..	40	41	44	40	40	41	38	40	37	37	34	35	34	36	34	35	38	35	37	36	35	32	33	32	48½ „
Formalin. „ „ ..	90	90	90	91	90	89	90	90	90	92	90	91	90	90	89	87	87	86	88	86	88	87	85	84	91 „

Control—No. of grains tested .	5,400	Bluestone—No. of grains tested	5,400	Formalin—No. of grains tested	5,400
„ „ „ germinating	5,131	„ „ „ germinating ..	2,613	„ „ „ germinating ..	4,919
„ „ „ not germinating ..	269	„ „ „ not germinating	2,787	„ „ „ not germinating ..	481

RICE-GROWING FOR VICTORIA.

RESULTS OF INVESTIGATIONS IN CORRESPONDENT CONDITIONS AS REGARDS CLIMATE AND SEASON IN SACRAMENTO VALLEY, CALIFORNIA, U.S.A.

[Several inquiries as to the feasibility of rice-growing in Victoria have been made to the Department from time to time. Except in one instance the growing of rice has not been attempted in Victoria, and as there was therefore no practical experience available, recourse was made to the United States Bureau of Plant Industry, whose Agronomist-in-Charge of Rice Investigations, Mr. C. E. Chambliss, kindly furnished me with his most recent report, "A Preliminary Report on Rice-growing in the Sacramento Valley," published last year.

Seeing that the conditions which led to the investigations detailed in the report are practically such as are now existent on certain of the Northern lands of the State available to irrigation, opportunity is taken to publish the report in full, so that those interested may judge for themselves of the possibility in their circumstances of undertaking trial areas with reasonable prospects of success. In applying the information in Mr. Chambliss' report to local conditions, the reverse seasons of the Northern Hemisphere need to be continually borne in mind.—Editor, *Journal of Agriculture*, Victoria.]

A PRELIMINARY REPORT ON RICE-GROWING IN THE SACRAMENTO VALLEY.

By Charles E. Chambliss.

Introduction.

In the Sacramento Valley of California there are large tracts of land that 30 years ago produced profitable crops of wheat and barley which are now not yielding crops of either grain in paying quantities. These tracts were first used for grazing cattle, but were afterwards converted into extensive grain ranches, which to-day might be as remunerative in yield as in the earlier days if maintenance of soil fertility had been valued as an asset. Under improved methods of farming, however, a large part of this area, depleted as it is in plant food, will still produce grain in quantity and of good quality at a profit. While crop rotation, diversified farming, and intensive culture will play conspicuous parts in the improvement of the agriculture of this valley, irrigation will play a more important part in the development of its agricultural possibilities, for through the intelligent use of water it is possible to obtain the full capacity of the crops now grown, and also profitable returns from crops which are not now cultivated in this valley.

Among the crops requiring water rice is worthy of a trial, but its successful cultivation is so dependent upon water that it should never be planted where the supply is not sufficient to submerge the land to the depth of at least 3 inches from the middle of June to the middle of September. If there is water enough during this period for a continuous submergence, the greatest obstacle to the production

of the crop is removed. There is no crop grown in California at present that requires so much water as rice.

Conditions under which Variety Tests of Rices were made.

In the spring of 1909, the Office of Grain Investigations of the Bureau of Plant Industry inaugurated tests to determine the adaptability of rice to the climate and soil of the Sacramento Valley. These tests were made on the black adobe soil lying on the east side of Butte Creek (approximately 9 miles west of Biggs, Cal. (Pl. I., Fig. 1). This soil is of a close, compact structure. When wet it has an exceedingly tenacious and putty-like consistency. During the dry season it breaks at the surface into blocks with deep fissures between them. These blocks upon long exposure are divided and subdivided by smaller fissures until the surface may become a loose, shallow mass of small pieces of the size of peas. In this condition the soil absorbs water readily, which is given up slowly under evaporation. The subsoil, which lies at a depth of approximately 3 feet, is very impervious, though water penetrated it to a depth of 6 inches before the plats were drained. The surface of the plats was nearly level, with just enough slope for good drainage into the narrow sloughs, which are features of the topography of this area of black adobe that may be used for conveying water for both drainage and irrigation.

Grain had been grown exclusively upon this land, though it was not under cultivation during the year preceding the tests. The land was ploughed in the autumn. The rains of the winter months reduced the clods and left the surface of the soil in a condition that required less work and expense to secure a good seed-bed than would have been possible if the entire preparation for planting had been postponed until spring.

The seed of each variety was planted with a drill to the depth of 1½ to 2 inches at the rate of 80 pounds per acre. On account of a lack of moisture in the soil at the time of planting, it became necessary to apply water to germinate the seed. This irrigation is not likely to be required when the planting is done immediately after the late spring rains or before the end of the rainy season. It would not be advisable to plant early except on well-drained land that had been ploughed in the autumn.

In the first irrigation the water was retained long enough to wet the surface of the soil thoroughly. The second application of water was made when the plants were approximately 3 inches high, which was sooner than would have been necessary if the soil had not become too compact on the surface when the plats were drained. From this period water was applied every seven to ten days to keep the soil moist. After the plants had tillered well the land was submerged to a depth of 3 to 5 inches. This submergence was continuous until the grain reached the hard-dough stage. At this stage of maturity the plats were drained for harvest. All varieties were allowed at least ten days in the shock before they were thrashed.

From the date of planting until 1st October there was less than 1 inch of rain. During the same period the average daily range of

temperature varied from *29° in May to †38° in August, with the greatest range occurring in July, August, and September.

TABLE I.—*Results of variety tests of rices*[1] *grown upon one-tenth acre plats on black adobe soil in the Sacramento Valley of California in* 1910.

G. I. No.	Date planted	Date land was submerged	Date of maturity	Days to maturity.	Height of plant including head	Length of heads	Heads per plant	Yield per acre[2]
					inches	*inches*		*bushels*
1533	Apr. 12	June 25	Oct 22	193	38	7·0	6–12	71·5
1561[3]	Apr 13	do	do	192	36	7 5	7–21	154 0
1562	do	do.	Oct. 1	171	40	7·5	7–10	131·3
1563	do	do.	Sept. 29	165	40	7·0	6–14	122·4
1582	do	do.	Sept. 2	142	31	7 0	8–22	42·8
1583[3]	do	do.	do.	142	33	7·0	8–15	47·1
1585	do.	do	do.	142	31	6·5	8–22	58·0
1597	Apr. 12	do	Sept. 7	148	28	6·5	5–14	71·3
1599	Apr 13	do	Sept 2	142	33	7·0	8–15	23·1
1600	do	do	Sept. 30	170	38	7·0	6–11	94·6
1602	do.	do.	Sept 25	165	36	7·0	9–20	77·7
1642[3]	Apr 12	do	Oct. 22	193	29	7 0	10–27	124·0
1643[3]	do	do	do.	193	38	7·5	6–12	69.3

[1] These rices, on account of the quality of their grain, were selected for planting in 1910 from 300 varieties which were grown here in 1909 on plats consisting of only 4 rows a rod each in length and 7 inches apart. The yields from the rices of 1909 were relatively much higher than in 1910, when the plantings were made on a larger scale. Estimated upon the actual yield from plats one-half acre in size, the Watarıbune (G. I. No. 1561) and Shinriki (G. I. No. 1642) varieties in 1910 yielded 113·7 and 137·2 bushels per acre respectively.

[2] Estimated upon the actual yields from one-tenth acre plats.

[3] See illustrations.

In this valley these rices require a longer time to mature, and they produce smaller plants than when grown on the plains of the Gulf coast, but they exhibit a greater capacity for tillering, with resultant larger yields.

Fig. 1.—General view of Rice Plats on Black Adobe Soil in the Sacramento Valley of California.

The short-grain rices appear to be better suited to this climate than the long-grain varieties (Fig. 2). They ripen more uniformly,

* Fah. 84·2. † Fah. 100·4.

though slowly, tend to shatter less, and produce larger yields. There is less sun-cracking of the grain in these varieties after ripening than in the long-grain rices, which will result, of course, in a larger percentage of head rice when milled.

The number of days for maturing the crop may be greatly lessened by stimulating the growth at the time the plants begin to "boot" by increasing the depth of water (Fig. 3), with a gradual lowering of it during this period, and by giving another impetus to growth by suddenly increasing the depth of water just as the heads appear. This last depth of water should be maintained until the heads begin to turn down, when the land should be drained for harvest. A shorter season and earlier planting seem desirable in order that the crop may escape the effects of the increasing humidity in September and October, which appears to lengthen the period of ripening.

The Honduras (Fig. 4) and Shinriki (Fig. 5) varieties (G. I. Nos. 1643 and 1642) are the leading commercial rices of the

Fig. 2.—A Plat of the Lencino variety of Rice (G.I., No. 1583) in flower. During this period the land is submerged.

United States. In this test these varieties have exceeded the maximum yields produced on experimental plats in Louisiana and Texas. Of the two rices, the Shinriki, which is a small-grain variety, is better adapted to the Sacramento Valley.

The Wataribune (G. I. No. 1561) (Fig. 6), the Oiran (G. I. No. 1562), and the Shinriki (G. I. No. 1642) varieties produce good yields, but on account of the long period which they require for maturity they may never become the leading rices of this valley, because the late planting of them might result in the loss of a crop. For this reason, early-maturing varieties of good quality, though producing less per acre, might be more remunerative. The other varieties included in Table I are introductions from foreign countries that will be described and discussed in a later publication.

Suggestions as to Methods of Culture.

In selecting land for rice it is very important to know whether the subsoil possesses the mechanical characters for retaining water, for in the irrigation of this crop a continuous submergence of the land

for several weeks is required. Such a condition is not possible unless the subsoil is sufficiently impervious to water, or unless, by tidal irrigation, the depth of water upon the land may be maintained continuously when needed, regardless of the nature of the underlying stratum of soil. On land that cannot be flowed by the tides the cost of submergence and the time required in the submergence depend upon the depth of the soil A soil with a depth of 20 inches is preferable to a deeper one, because less water will be used and less time consumed in flowing the land. However, heavy clay soils of great depth that can be well prepared and drained may be used advantageously for the crop, but comparatively shallow soils must be underlain by an impervious subsoil or so located as to be subject to tidal overflow. These details of irrigation, an item of great expense in the production of rice, must be considered to secure maximum returns.

Fig 3.—A Plat of the Wataribune variety of Rice (G.I., No. 1561) in "Boot." During this period land is submerged.

Soil of a compact nature seems well adapted to rice. Clays, for this reason, if they are not too deficient in organic matter and can be effectively drained, are preferred to other soils, because they dry out more readily at the surface and become solid after the removal of the water, making the fields accessible at harvest much sooner than would be possible on the more open soils. The culture of rice, however, is not confined to clay soils, for wherever water can be economically handled by irrigation and drainage loamy and even sandy soils will produce good crops.

When not contrary to good farm management and the nature of the soil will permit it, land for rice should be ploughed in the late autumn and well drained. With good drainage at this time the alkali which has accumulated just below the surface will be washed out by the winter rains. Furthermore, the action of the weather during the dormant period will have the effect of pulverizing the soil and making possible a good seed-bed at a minimum cost. If ploughing is postponed until spring, the land should not be left in

furrow, but should be harrowed at once and not allowed to dry out before planting. High germination and vigorous growth of the young plants are dependent upon a good seed-bed. The importance of its preparation cannot be emphasized too strongly.

The seed may be drilled or broadcasted. Large, heavy, flinty seed, uniform in size and free from sun cracks, should be used. The cracking of the grain by the sun occurs when the plants are allowed to stand too long after ripening or when the heads of rice are exposed in the shock. In thrashing and in cleaning by a fanning mill, grains are often cracked, but this may be easily prevented by the proper adjustment of the machinery. This imperfection in the seed is not easily detected, because the husk which envelops the kernel remains attached when the grain is thrashed. Sun-cracked and machine-cracked seed will not produce vigorous plants.

The seed should not be sown deeper than 1½ inches. In a well-prepared seed-bed a less depth is desirable if the proper conditions of moisture exist. On a cloddy seed-bed greater depth is required

Fig. 4.—A Plat of the Honduras variety of Rice (G.I., No. 1643) at full maturity.

in order that all seed may be covered. A drill should be used to get a uniform depth and distribution of seed, for these conditions insure an even stand, which is an advantage in controlling weeds. In broadcasting seed there is always danger of getting a very uneven stand, due to difficulties in covering. Poor seeding reveals itself again at harvest when the rice does not ripen uniformly, which always means a loss, whether the field is cut when ripe or when portions of it are immature. This loss may come from the shattering of grain from the mature plants or from the low marketable product caused by small and poorly-formed kernels.

The rate of seeding will vary according to the variety of rice, the vitality of the seed, the character of the seed-bed, and the method of seeding. With the small-grain rices, which, as a rule, tiller heavily, the quantity of seed that should be sown per acre should be less than with the large-grain rices that do not tiller so strongly. Too thin seeding, however, induces excessive tillering, which invariably results in irregular ripening and low-grade rice. The sowing of seed of good vitality in a well-prepared seed-bed will always give better results

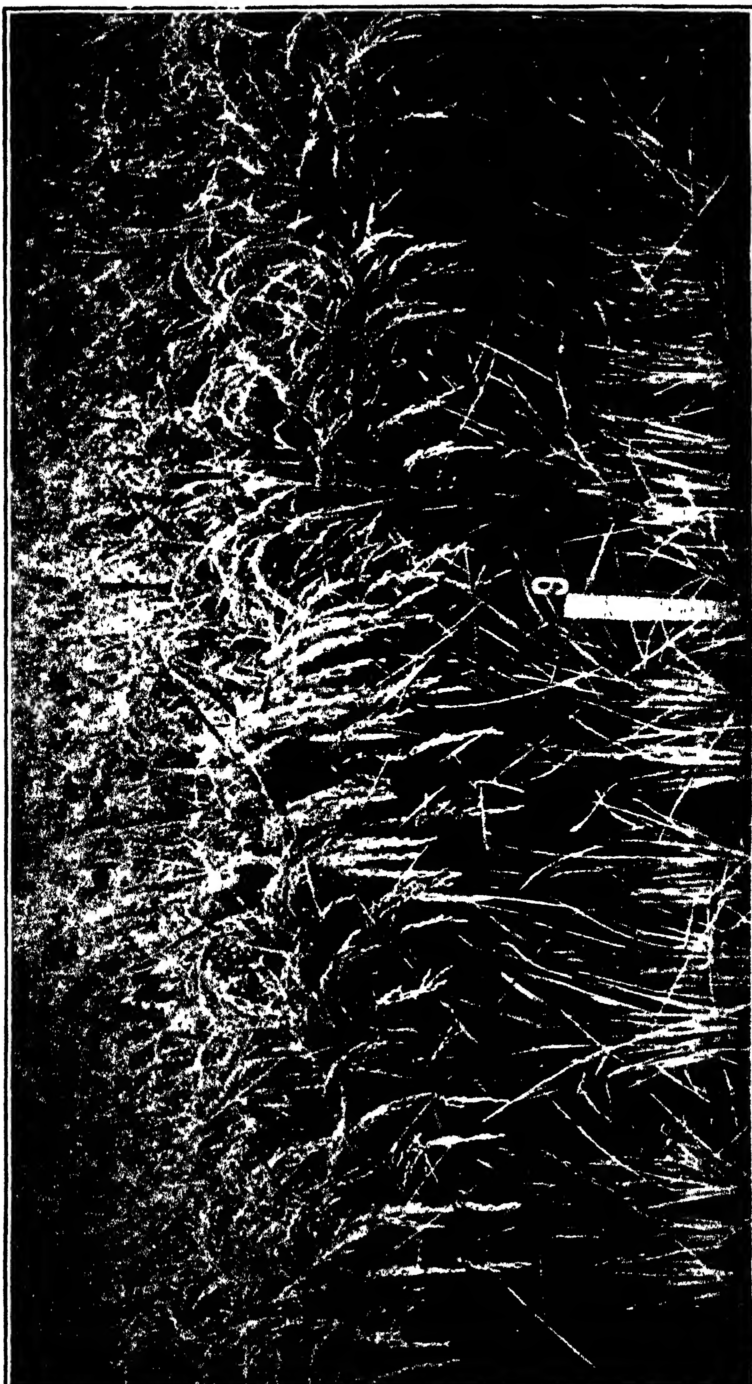


Fig. 5.—A Plat of the Shinriki variety of Rice (G.I., No. 1642), at full maturity. This variety requires a long season and should not be planted later than 15th April in the Sacramento Valley.

than the sowing of seed of low vitality in a poorly-prepared seed-bed. A smaller quantity of seed is used when drilled than when broadcasted.

Rice should be sown late enough to escape the extreme cold weather of spring, but early enough to mature before the autumnal rains. Sowing in April usually will be safe, as the crop will seldom be exposed to low temperatures.

Level tracts of land with sufficient slope for effective drainage, if they possess the required characters of soil and subsoil, are admirably suited for rice. In the use of such lands for this crop the field should be enclosed by strong embankments and so subdivided that each subfield shall have a surface level enough to hold the irrigation water at a rather uniform depth, and yet with the necessary slope for good drainage. These conditions are obtainable by constructing the field levees on contour lines at distances which, during submergence, will hold the water at a depth of approximately 5 inches on the lower side, and 3 inches on the upper side of each sub-field. These levees should be just high enough to prevent the water from overflowing into the sub-fields below and broad enough to allow all kinds of machinery used in the cultivation of rice to pass over them easily and without damage to them. The planting of the field levees, which is made possible by their construction, will leave no uncultivated strips of land in the field for the growth of weeds, and though the rice upon them may not be equal in every respect to the main crop, the results obtained in the control of weeds alone will justify the practice. Such levees are permanent, and with little money and time can be kept in excellent condition.

The successful cultivation of rice is dependent upon an abundant and always available supply of water. This does not mean, however, that the land upon which the crop is grown must be submerged during the entire season. Under the favorable conditions of a good seed-bed, water need not be applied for germination. However, the soil should never be allowed to dry out. This will require frequent irrigation.

After the plants have tillered well, the land should be submerged for a week to as great a depth as the levees will allow. At the end of this time the water may be lowered in the sub-fields to approximately 1½ inches and kept at this stage until the plants begin to "boot." when the water should be applied again to the maximum depth for a few days (Fig. 3). After most of the heads have appeared, the water should be applied for a third time to its maximum depth and maintained without fluctuation until the heads are well turned down (Fig. 5). At this stage of growth the fields should be rapidly drained.

With effective drainage (Fig. 6) the ground will be dry and firm enough within two weeks to support the weight of the harvesting machinery. Rapid drainage of the fields at this time is imperative if the crop is to be harvested at the least expense in labour and loss of grain. It can be easily obtained through open ditches, varying in depth from 2 to 4 feet, if properly located and kept free of weeds and other obstructions. Even with increased power the self-binder cannot do efficient work on wet ground, and the delay in harvesting on account of a boggy field invariably results in reduced yields from the shattering of the grain. Besides facilitating the field operations

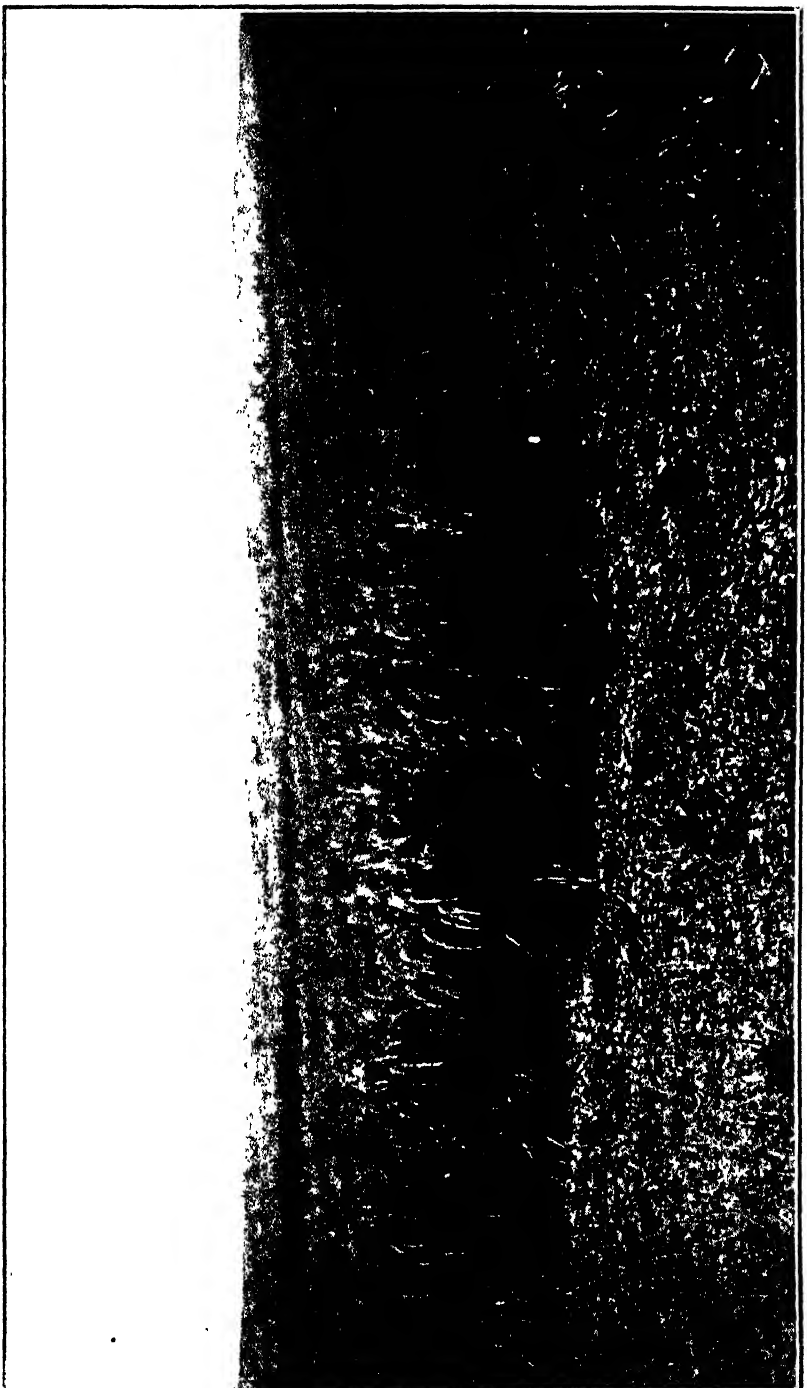


Fig. 6.—A tenth-acre Plat of the Wataribune Variety of Rice (C.I., No. 1561), drained for harvest. This variety requires a long season and should not be planted later than 15th April in the Sacramento Valley.

at harvest, thorough drainage is needed for other purposes. With a crop that requires water so constantly and abundantly as rice, there is always danger of the soil becoming water-logged unless provisions are made for removing the surplus water. A well-aerated soil is just as essential for rice as for any other crop if maximum yields are to be maintained. To prevent alkali from accumulating in dangerous quantities and for the control of aquatic weeds a good drainage system is a necessity, and makes possible the rotation of crops, which must be practised if the fertility of the soil is to be conserved.

The rice crop is valued not so much for the yield in bushels as for the yield in pounds of head rice, or whole grains, which it will produce when milled. It is therefore important that all parts of the field should mature simultaneously, and that there should be no delay in harvesting, for a lack of uniformity in ripening produces too many chalky grains that do not mill well, and the long exposure of ripe grains to the sun produces cracked kernels that break readily in the process of milling.

The milling quality of rice is further increased by prompt and careful shocking. As soon as the grain is harvested, the sheaves should be put into round shocks. These shocks must be strongly built to withstand the wind, and well capped to protect the grain from rain and sun. During dry weather the process of curing requires at least two weeks. This period is considerably prolonged during rainy weather. Under no circumstances should the grain be thrashed until the kernel is hard and the straw thoroughly dry. After thrashing, the quality of the grain may be seriously affected by exposure to rain and sun. For this reason thrashed rice should be stored at once under a good cover.

Summary.

Clay soil with an impervious subsoil, if it lies in level tracts and can be well drained, is well adapted to rice.

Shallow soils are preferable to deep soils, because less water will be required to submerge them.

For rice there should be an abundant and always available supply of water.

To prepare a good seed-bed on black adobe soil it is better to plough in autumn than in spring.

Sow with a drill.

Plant in April if the land is dry and firm enough to support teams and implements.

Do not allow the soil to bake.

Keep the necessary moisture in the soil by frequent irrigation.

Keep the land submerged from the time the plants have tillered well until the heads turn down.

Provide for thorough drainage.

Build shocks to protect the grain from sun and rain.

Keep the rice in shocks at least ten days before thrashing it.

Conclusions.

The results from a two-year test of 300 varieties of rices on black adobe soil near Biggs, Cal., indicate the possibility of rice culture in

the Sacramento Valley. The successful introduction of this crop is dependent upon an abundant supply of water, which must always be available during the growing season. The soil area adapted to rice in this valley is sufficiently large to produce many times the 55,000,000 pounds of cleaned rice which are consumed each year on the Pacific Coast. How much of this area has sufficient available water for proper irrigation is uncertain, though for a good portion of it there is apparently an abundant supply. Increase in the rice acreage should therefore be made with care.

BEE-KEEPING IN VICTORIA.

(*Continued from page* 371.)

By F. R. Beuhne, Bee Expert.

XIV.—DISEASES OF BEES—*continued.*

A disease of the brood of bees which, while somewhat resembling foul-brood in appearance, but without the characteristic ropiness of the dead larvæ, has for some years attracted the attention of bee-keepers in other countries. That this disease is distinct from foul-brood is proved by the fact that in the study of samples carried out by Dr. G. F. White, of the United States Bureau of Entomology, no micro-organisms were found either culturally or microscopically.

This disease is present in Victoria, and, as it will sometimes entirely disappear or yield to the cutting out of the affected brood, the temporary success of this superficial treatment has, in some cases, caused the adoption of this method for the treatment of foul-brood, for which it was mistaken by bee-keepers.

Even when this disease disappears without treatment, it may reappear the next season. As it has been proved to be infectious, bee-keepers are advised to treat affected colonies in the same way as those suffering from foul-brood; that is, by the removal of all infected material from the hive.

Dr. G. F. White commenced the study of this disease in 1902. In a pamphlet just issued by the United States Department of Agriculture he gives it the name of sacbrood, on account of the sac-like appearance of the dead larvæ, which can be removed from the cell without rupturing their body wall.

Sacbrood.

On page 3 of the pamphlet referred to, Dr. White, concerning the symptoms, says:—

" The strength of a colony in which sacbrood is present is frequently not noticeably diminished. When the brood is badly infested, however, the colony naturally becomes appreciably weakened thereby. The brood dies after the time of capping. The dead larvæ are therefore almost always found extended lengthwise in the cell and lying

with the dorsal side against the lower wall. It is not unusual to find many larvæ dead of this disease in uncapped cells. Such brood, however, had been uncapped by the bees after it died. In this disease the cappings are frequently punctured by the bees. Occasionally a capping has a hole through it, indicating that the capping itself had never been completed. A larva dead of this disease loses its normal colour and assumes at first a slightly yellowish tint. 'Brown' is the most characteristic appearance assumed by the larva during its decay. Various shades are observed. The term 'gray' might sometimes appropriately be used to designate it. The form of the larva dead of this disease changes much less than it does in foul-brood. The body wall is not easily broken, as a rule. On this account often the entire larva can be removed from the cell intact. The content of this sac-like larva is more or less watery. The head end is usually turned markedly upward. The dried larva or scale is easily removed from the lower side wall. There is practically no odour to the brood combs.

"The Infectious Nature and Cause of Sacbrood.

"In the study of samples of this disease received directly from bee-keepers no micro-organisms have been found, either culturally or microscopically, to which the cause of the disease can be attributed This fact, together with the fact that the disease often disappears without any great loss to the colony, would tend to indicate that the disease is not infectious. The experimental evidence which I have obtained proves, however, that the disease is infectious.

"Experimental Work with Sacbrood.

"Evidence has been obtained by me that sacbrood can be transmitted from diseased to healthy brood. Three healthy colonies were inoculated, each with diseased material from a different locality, and in each of these three experimental colonies the disease was produced. These results indicated at once that sacbrood is an infectious disease. The microscopical and cultural study of the infected and dead brood in these experimental colonies, as in the case of the diseased brood in samples direct from the apiary, failed to show any organism to which the cause of the disease could be attributed.

"This led naturally to a study of the condition to determine whether or not the virus of the disease was so small that it had not been seen. To obtain evidence on this point material containing the virus was filtered using an earthenware filter. The three colonies in which the disease had been produced experimentally furnished the disease material for the experiments. Larvæ, sick and dead, of sacbrood were picked from the combs, crushed, and diluted with sterile water. This suspension was filtered by the use of the Berkefeld filter. From each of the three diseased colonies a separate filtrate was obtained, which was fed in syrup to healthy colonies. Six colonies were thus fed—two with each of the three separate filtrates. As a result of these inoculations sacbrood with typical symptoms of the disease was produced in all of the six colonies thus fed.

"One more experiment will be mentioned at this time. In this the diseased brood used was taken from one of the colonies in which the

disease had been produced by feeding filtrate. Disease material from this colony was filtered as before and fed to two healthy colonies, with the result that sacbrood was produced in each. It might be mentioned here also that other experiments made indicate that the virus is killed by the application of a comparatively small amount of heat.

"In eleven colonies, therefore, sacbrood has been produced experimentally by feeding to healthy colonies the virus of this disease. In eight of the eleven colonies the disease was produced by virus that had passed through the Berkefeld filter. The disease, therefore, which bee-keepers have for a long time recognised as being different from either American or European foul-brood, has now been demonstrated to be an infectious disease that is caused by a filterable virus.

"The conclusion to be drawn from this work, therefore, is that sacbrood is an infections disease of the brood of bees caused by an infecting agent that is so small, or of such a nature, that it will pass through the pores of a Berkefeld filter.

"The three principal brood diseases, then, are now all known to be infectious. These diseases are—American foul-brood, caused by *Bacillus larvæ;* European foul-brood, caused by *Bacillus pluton;* and sacbrood, caused by a filterable virus."

Diseases of Adult Bees.

While the causes of brood diseases of bees are well known, the state of our present knowledge of the diseases of adult bees is much less satis factory. The latter are three in number—Paralysis, dysentery, and disappearing trouble.

Bee Paralysis.

This is a disease of the adult bees, the cause of which is still unknown. The first indication is the presence in the colony of a few shiny, emaciated looking bees; these are still capable of flight, and some will go foraging, but they often fail to return, remaining on flowers and other objects and die. Later on numbers of bees with abnormally inflated abdomens will be noticed in the hive. They may be noticed about the hive entrance, their wings and legs extended sideways, giving them a sprawling appearance. Their movements are jerky, and their wings quiver at intervals. When a hive is opened some of the bees so affected will, after a few minutes, come on top of the frames. When smoke is blown amongst the bees they remain on top, while the healthy ones run down between the combs. After paralysis has been present in a colony for a considerable time even the newly-hatched bees may become infected. They crawl from the hive, fall over on their side or back, just move their legs now and again, and do not die till many hours later. In the case of these young bees, there is no swelling of the abdomen and no quivering of the wings.

Paralysis in Victoria is more prevalent north of the Dividing Range than in the coastal country, but whether this is due to climatic influences or to variations in the food supplies is not known. Many remedies have been advocated, such as sprinkling the bees with sulphur flour, spraying them with brine, or feeding medicated syrup, and although the disease is often checked for a time, no cure is effected. When using sulphur the brood should be removed, as otherwise the sulphur will kill

all the unsealed brood and eggs. The brood removed may be given to any other colony without risk of infecting it, provided care is taken to shift none of the adult bees with the combs. There is no doubt that some strains of bees are predisposed to paralysis, and the only treatment known to be at all effective is to kill and replace the queen of every hive showing the first symptoms of the disease, and thus gradually eliminate it. If the new queen is of the same strain, or of another one equally predisposed, no cure will result. In obtaining queens from elsewhere for the purpose of re-queening colonies showing paralysis it will be better to get them from an apiary from which the disease has been eliminated than from one in which it has never made its appearance, because in the former the queens would be from stock which proved immune in contact with the disease, while in the latter there has been no such test.

It is of the utmost importance that on no account should queens be raised or kept from stocks which show signs of paralysis, no matter how desirable they may be in all other respects; further, the queens of all affected hives should be replaced as soon as possible, to prevent the raising of predisposed drones, which by mating with the young queens would perpetuate the weakness in the apiary.

Dysentery.

The symptoms of dysentery of bees are the soiling of the hive entrance and the immediate surroundings with the watery excrement of the bees. This is brownish-yellow, and has a disagreeable smell when dysentery is present, while under normal conditions it is darker in colour, and drier, and is voided at a greater distance from the hive. This spotting of the hives and surroundings usually occurs in spring, when the bees have been prevented from taking a cleansing flight by a long spell of cold weather. When bees winter on thin, watery honey they have to consume greater quantities to produce the required animal heat than when their winter food is of proper density. Bees in a healthy state do not void inside the hive, but when, owing to inclement weather, they are unable to fly, there is, on account of the consumption of a large amount of diluted food, such an accumulation of waste in their bodies that they are forced to discharge it inside the hive, soiling each other and the combs. Before this condition is reached the bees are so surcharged with accumulated waste that they are unable to consume sufficient honey to maintain the animal heat necessary, and many perish. The cause, as already indicated, is the consumption of watery honey during cold weather. Honey may be too thin for winter food, because it was gathered so late in the season that the bees were not able to evaporate it to its proper density on account of low temperature and humidity of the atmosphere, or it may have absorbed water from the air because it was not sealed and not covered by the cluster of bees.

With the approach of warm weather, colonies suffering from this type of dysentery will recover, provided sufficient bees are left. As a preventive, I would recommend removing all surplus combs and boxes from the hives at the approach of cold weather, and confining the bees to just the number of combs they can cover. If this is done the bees will be prevented from storing outside the cluster honey which they

may gather on odd fine days, also the loss by radiation of the heat generated by the bees will be reduced to a minimum, thus economizing in the consumption of stores and avoiding an excessive accumulation of waste matter in the bodies of the bees.

INFECTIOUS DYSENTERY.

This is a disease which has caused enormous losses of bees in Great Britain and Germany. Dr. Zander, of Erlangen, Bavaria, first drew

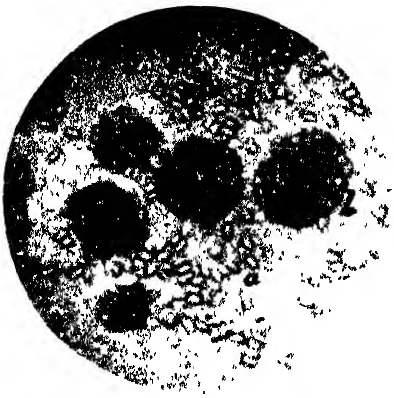


Fig. 1.

Fig. 2.

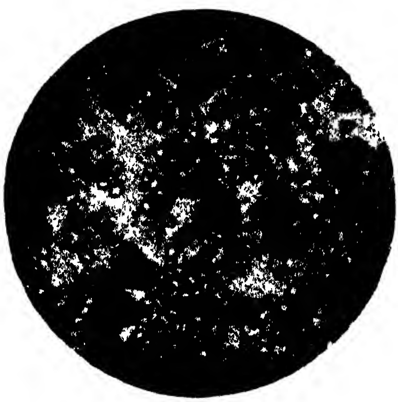


Fig. 3.

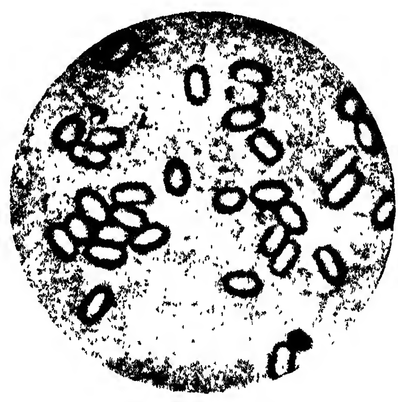


Fig. 4.

[Illustrations reproduced from *Handbuch der Biene*, Vol. II., by Prof. Dr. Enoch Zander:—Figs. 1, 2, Nosema spores, (*a*) single spores, (*b*) intestinal cells filled with spores × 400. Fig. 3, Nosema spores (Australian) (P.), Eucalyptus pollen × 400. Fig. 4, Nosema spores × 1,000.]

attention to it at a meeting of German bee-keepers held at Weissenfels in August 1909. The disease is a malignant type of dysentery, caused by the invasion of the digestive tract of the bee by an animal parasite of oval shape, which multiplies with great rapidity, and by the destruction of the cell wall of the chyle stomach causes the death of the bee Dr. Zander discovered this organism during 1907 in the intestines of bees suffering from malignant dysentery, and named it *Nosema apis.*

This parasite, when in the spore (dormant) stage, is oval in shape, and measures about 1-200 mm. in length by 1-500 mm. in breadth (Figs. 1, 2, 3, 4). Infection is spread by means of the spores voided with the excreta of diseased bees coming into contact with the bees' food or drinking water. The visible symptoms are described by Dr. Zander as follows:—" Sudden mortality of large numbers of bees within or outside the hive. The bees become restless, separate from the cluster, fall off the combs, crawl excitedly out at the entrance, and, unable to fly, collect on blades of grass and other objects, and sooner or later die, the abdomen being more or less inflated."

In May, 1912, the British Board of Agriculture published a report on the bee mortality, known in Great Britain as the Isle of Wight Bee Disease, giving the results of the investigations of Dr. Graham-Smith, H. B. Fantham, Annie Porter, G. W. Bullamore, and Dr. W. Malden In this report the name of *microsporidiosis* is given to the Isle of Wight Disease and *Nosema apis* as its cause. In regard to symptoms, the authors state—Inability of some of the diseased bees to fly, the presence of numerous bees crawling on the ground in front of the hives, and the gradual dwindling of stocks are common, but many other symptoms have been recorded, and no one symptom is characteristic of the disease. The only essential feature is the death of large numbers of bees, and often of the whole stock, especially during wet and cold periods of the year or during the winter months.

The presence of the *Nosema apis* parasite in Australia was first discovered in October, 1909, and made public in the *Journal of Agriculture,* January, 1910. It was then generally assumed that the heavy losses of bees occurring at intervals in certain districts of Victoria and some other States were caused by *Nosema apis.*

Since then the microscopical examination of bees from all over Victoria, the adjoining States, and Tasmania have shown that *Nosema apis* is present in almost every apiary, and equally numerous in the intestines of bees from localities where no losses have ever occurred Out of 84 lots of 20 bees, each obtained from different apiaries, and examined by Mr. W. Laidlaw, B.Sc., Biologist, Department of Agriculture, only two apiaries were proved free from the parasite in the 20 bees examined. If, therefore, *Nosema apis* is a factor in what is known as the disappearing trouble, it does not appear to be the only one, since in many localities bees are exceedingly prosperous, notwithstanding the presence of the parasite in their organism.

These micro-organisms were first noticed by Dönhoff and Leuckart in 1857, but regarded as vegetable parasites, *protozoa* being at that time unknown. Bees were then not kept in such large numbers of colonies in one spot, and the frame hive being then not known, new combs had to be built by the bees after every robbing of the hives. With the advent of the frame hive system bees began to be kept in apiaries, numbering hundreds of colonies, the old combs were used for many years, and the swarms hived and placed close to the old hives. Whenever large numbers of animals are kept for any length of time on the same spot diseases break out, unless certain precautions are taken. In the case of bees in a state of nature, their nest is usually some distance from the ground; all refuse and dead bees thrown out, as well as the excreta, fall to the ground out of harm's way. When a swarm

issues, it establishes a new home some considerable distance away in clean surroundings, where it builds new combs. In the case of a modern apiary, large numbers of colonies are kept on a comparatively small space; the hives are on the ground, which in time becomes contaminated with excrement, dead bees, and refuse from the hives. The bees are compelled to breed in the same combs year after year. The causation of disease by micro-organisms depends upon the amount of resistance which the invaded host offers and the degree of infection which takes place. A vigorous, well-nourished animal will overcome a degree of infection to which a constitutionally weak one, or an ill-fed one, would succumb. The modern apiarist, by keeping large numbers of colonies on a limited space for years, and using the same brood-combs continuously, has thereby raised the degree of infection to which the bees are subjected, while by breeding his queens for prolificness and colour he has weakened the race and reduced its vigour and resistance to disease.

To counteract these results of the present day system of bee-keeping remedies may be found in the periodical shifting of apiaries on to new ground (the further from the old site, the better), the replacing of the brood-combs with new ones at intervals of a few years, and the restoration of the bees to their original vigour, by breeding all queens from stocks giving the highest yields of honey (an indication of longevity) and not from colonies with an abnormal amount of brood only.

(*To be continued.*)

TAGASASTE.

(*Cytisus proliferus, Linn. f.*—Commonly called Tree Lucerne.)

ECONOMIC AND ORNAMENTAL PROPERTIES.

By J. W. Audas, F.L.S., National Herbarium, Melbourne.

Tagasaste has been so long known as "tree lucerne" that it is becoming difficult to challenge its claim to the name. It is not the plant to which the name "tree lucerne" properly applies, as the more rightful owner of the title is another member of the *Leguminosæ* viz., *Medicago arborea*, a native of Italy, where it grows to a height of 6 feet, and is tree-like as compared with ordinary lucerne (*Medicago sativa*), but differs from it in appearance somewhat. The origin of the misappellation is probably due to the striking similarity of the foliage of "Tagasaste" with that of ordinary lucerne. Tagasaste is a shrub indigenous to the Canary and Madeira Islands, the home of so many of the Cytisus or Laburnums. Although introduced to Australia fully 30 years ago, this plant has never received the cultivation it merits, and it is to be regretted that its many good qualities have been so long overlooked. Throughout all the plain country of the Mallee districts of our State, where it should be especially valuable, it is practically unknown, and only of late years has it been grown near Melbourne.

Although impossible in the space of a small article to deal with all its uses, I wish, for the benefit of bee and poultry keepers, to bring a few of its more valuable features under notice.

Uses.

If grown at apiaries as hedges or shrubs it is a valuable acquisition in an ornamental sense, but more particularly on account of the profitable quality of its very melliferous white flowers, which are borne in profusion at a time when there is little else blooming; this period being in Victoria from about June until August. Poultry farmers are beginning to perceive the value of Tagasaste, and those who have initiated its cultivation are enthusiastic in praise of it. If grown in the fowl runs it provides excellent shelter, and the tender leaves are relished as the necessary "greens," while when allowed to grow up into young shrubs or trees, and no longer within reach of the birds, it flowers, and in due course the seeds falling from the bursting pods, supply another valuable food. As a fodder plant it has qualities which place it far above many better known ones, being green all the year, and is easily cultivated. It remains uninjured by frost and withstands drought well, and should therefore prove a means whereby Mallee farmers could raise the stock-carrying capacity of their land to equal that of districts with a more favorable rainfall. But perhaps the supreme utility of Tagasaste will be found in its uses as shelter belts or wind breaks, being superior in certain localities to the sugar gum and pepper tree, which are so favored for that purpose, for, unlike these trees, whose roots spread near the surface and thus render a considerable area of land useless, those of the Tagasaste penetrate deep into the subsoil, so that grass and smaller plants grow uninjured beneath it. This deep rooting quality renders it useful in market gardens, for when sown between rows the seed will spring up quickly and protect tender plants from wind and frost

Cultivation.

The manner of cultivation must be varied according to the purpose for which it is being grown. If intended for fodder it should be sown thickly and frequently cut to keep the foliage tender, for it will be readily understood that horses and cattle, which relish it exceedingly in this way, soon show a dislike and reject it, if it is allowed to grow harsh and woody. Every cutting renders the crop more valuable, and it will yield more fodder to the area under cultivation than almost any other plant, supplying a diet on which horses will thrive and fatten, and which, when mixed with grass or straw, is equal to the best wheaten hay. The germination of the seeds may be hastened by soaking overnight in boiling water, but this treatment is not essential, for being very hardy, they will spring up quickly on almost any loose soil, and should be thinned out in distances varying with the ultimate size of trees. I should suggest for hedges about 4 or 5 feet, and for shelter belts 8 to 10 feet. The growth of a year gives the trees sufficient height to protect crops and small fruits, or vineyards, while three years should furnish a growth of 15 feet and upwards, and the trees will be sufficiently large to form an excellent wind break for large orchards. Tagasaste finds most congenial conditions in a sandy soil and warm climate, and can only be said to have one weak point in its climate-resisting armory, that is, its aversion to damp; therefore, land in preparation for planting should be well drained, and it is not advisable to attempt its cultivation in low-lying or swampy areas.

REVIEW OF THE BUTTER SEASON IN VICTORIA, 1912-13.

By P. J. Carroll, Senior Inspector, Dairy Produce.

The season about to close is not remarkable for any new developments in the export trade in butter.

The total butter exported from Victoria to all destinations from 1st July, 1912, amounts to 15,226 tons, having an approximate C.I.F. value of £1,690,086. This total includes 698 tons of butter from Tasmania, and 214 tons from other States, so that the butter of Victorian production shipped was only 14,314 tons, valued at £1,588,854. This compares unfavorably with 20,234 tons of Victorian butter, worth £2,529,250, exported last season, and 25,154 tons for 1910-11 worth £2,641,170.

This falling-off in production can only be attributed to the climatic conditions prevailing throughout the State, and to the fact that not sufficient provision is made for the stock during these dry periods. It would not be difficult, indeed, to increase our average production from 25 to 30 per cent. from the same number of cows if an abundance of fodder were made available at all times. It has come under my own notice on more than one occasion where cows have practically doubled their yields in one week when removed to better pastures. Let us hope, however, with the spread of closer settlement and the development that is taking place in the irrigation districts, that better methods will prevail. Under a proper system of irrigation and rotation it is possible to have an abundance of green fodder the whole year round.

In addition, whilst dealing with the question of increased production, it might be opportune to here mention that according to recent reports and statements in the press relating to the condition and prospects of the London market, dairy-farmers will be obliged to accept lower values for their produce in the future.

Co-incident with this reduction in value must come a corresponding reduction in the cost of production, if the business of dairying is to be carried on profitably. Dairy-farming, with all its attendant hardships, is not the gold-mine it is asserted to be by those outside the fence. Under the best of conditions, it means long hours and close attention to work. If the product of that labour is to be sold on a lower basis, then the dairyman must adopt different methods. The first and most important step, to my mind, is the growing and conservation of fodders, so that, to a reasonable extent at least, they will be independent of extremes in the climate.

The present prospects offer one of the best opportunities for putting this doctrine into practice. In no instance, within my recollection, have the dairymen and farmers generally had such excellent prospects for a bountiful season. The rainfall has been ample without being excessive, the almost entire absence of frosts and the genial weather has promoted the rapid growth of crops and pastures, and left the land in a suitable condition for preparation and cultivation

*Paper read before the Twentieth Conference of Australasian Butter and Cheese Factories Managers' Association, May, 1913.

for summer crops. I trust that factory managers will interest themselves in this matter, and impress upon their suppliers the wisdom of taking advantage of the season and planting additional reserves of fodder.

The next step of importance is the culling and improvement of herds. It is well known that a cow returning 300 gallons of milk per annum will consume as much food and require as much attention as one producing 600 gallons, with the difference that the latter will return a profit over and above the cost of labour and food, whilst the former fails to reach the limit of cost, and is therefore loafing on the dairyman. Under present conditions, the dairy-farmers cannot afford to keep these cows at a loss, and should endeavour to eliminate the loafers from their herds at the earliest opportunity.

Prices.

The highest average price received for butter during the past season on the London market was 117s. 1d. per cwt.

The average price of all butters, according to the certified copies of weekly official reports issued by the Home and Foreign Produce Exchange Ltd., is 111s. 9d. per cwt., or a discrepancy of 5s. 4d. per cwt. between the highest average price realized by any one factory and the average of the whole of the State. This discrepancy in price, when applied to the whole of the exports for the season, amounts to the sum of £70,189. It is needless for me to comment on this condition of affairs; the facts speak for themselves, and the remedy is obvious. Another disquieting feature in connexion with the question of prices for the past year is the fact that the range of prices between that realized for Danish, New Zealand, and Victorian butters has widened considerably, as shown herewith.

During the season 1911-12 the average prices for Victorian butter were 10s. below Danish and 3s. below New Zealand, whilst for the season 1912-13, Victoria was 18s. 2d. behind Danish and 5s. 7d. below New Zealand. It is evident from this that the popularity of Victorian butter is rapidly declining, or the manner in which the butter is placed before the consumers is not such as to enable us to obtain full value for our produce. This decline in value is out of all proportion to the slight falling-off shown in quality which I will deal with further on.

Grading.

Early in the present export season the compulsory grading and grade branding of butter was considered by the High Court to be *ultra vires*. Notwithstanding this fact, however, a check has been kept upon the quality of all butters exported through the Government Cool Stores, particulars of which will be referred to later.

Although grade-stamping was practically suspended at the time of the decision above referred to, many manufacturers and exporters availed themselves of the voluntary provisions of the Act, with the result that for the season up to date, 47.6 per cent., or nearly half of the whole of the butter sent forward for export, was shipped, bearing the Government grade stamp on the boxes. Up to the present, not one complaint regarding grading has been received from the London

end, and I can only conclude that the verdict of the graders met with the approval of the purchasers of the butter.

I trust that when the subject of grading is under consideration again that provision will be made for the issue of advices regarding quality to factories for each consignment of butter forwarded for export. Whatever difference of opinion exists amongst manufacturers and exporters regarding the merits of grade stamping, I think there is only one opinion on the question of grading, from an educational point of view, and I would strongly urge the Government to extend its efforts in this direction by combining, with the system of grading, practical instruction in the factories the same as is done in New Zealand.

That there is need for further improvement in our methods of manufacture is evident from the nature of the awards and the remarks of the graders.

Quality.

I regret to have to report a slight falling-off in the average quality of our export butter as compared with the previous season.

The following shows the relative percentage of the different grades for the past two seasons:—

	1911-12.	1912-13	
Superfine	16·74	14·39	– 2·35
1st Grade	58 43	60 09	1·66
2nd Grade	22 78	22·97	·19
3rd Grade	1·87	2·51	·64
Pastry	0·18	0·04	– ·12

Average grade, 90.79 as against 91.07 for the preceding season.

Although the difference is not great, it is unfortunately in the wrong direction, and it behoves us to put forth all our best efforts to not only maintain our present standard, but to improve upon it. I cannot do better than to quote here in support of this contention the remarks of Mr. James McKenzie, chairman of the Gippsland and Northern Co-operative Selling Coy., as published in the *Gippsland Standard* on Friday, 28th March, 1913, when presiding at a shareholders' meeting of the Yarram Butter Factory. Mr. McKenzie had just returned from an extended trip to the Old Country, during which time he stated that he had made close inquiry into the conditions of the London butter market. Amongst other things he said, "the matter of most moment to us is to set some comprehensive scheme in motion to improve the quality of our butter, and prevent the manufacture of anything but the best." "Margarine will never capture or displace the legitimate trade for our choicest butters, and it is only that grade which will have any chance of holding its place on the London markets," and further, in the Melbourne *Herald*, of 29th January, 1913, the same gentleman writes: "I did hint at the means of minimizing that competition. Make the very best high quality butter and send such only to Great Britain, then the competition is minimized."

This is plain language, and unmistakable in its meaning. I can commend it to both managers and dairymen alike. It is also a complete answer to the statements made that poor quality butter improves

in transit, and not infrequently realizes as good prices as butter of better quality on the London market.

The question of the necessity for improvement in quality has been dealt with by the press and the people interested in the trade in London. The experience of the past season has more than emphasized the truth of these statements and comments, and I think it is now time that those directly interested in the production of butter should take a hand in the matter themselves. It is a well-known fact that herds of cows do not produce cream that will make second or third-class butter at time of production. Deterioration takes place between that stage and the time the manufactured product is placed upon the market. If no other means are at hand, I think it would be perfectly within the rights of the State and the Commonwealth to make a law prohibiting the export of butter below a certain standard, and thus protect and conserve the reputation of an industry which was at one stage of our history the salvation of the State, and has been ever since, and will continue to be, if conducted on right lines, one of our staple industries. No other industry offers so many opportunities for placing people on the land and insuring them a livelihood; in fact, there is no industry in this State which lends itself so readily to the increase of our rural population as that of dairying. Are we to allow its very existence to be threatened, its usefulness as a factor in opening up and developing this country to be destroyed, because we fail to realize that, in order to maintain our hold upon the consumers of England, we require to produce an article that would not have as a competitor a cheap substitute such as margarine, but a butter the quality of which will do credit to Victoria?

Composition.

Butter-Fat.—As only two consignments, representing 58 cases, were detained for deficiency in fat, it is reasonable to assume that the average was well above the prescribed standard.

Moisture.—The average moisture contents of the 2,207 samples of butter analyzed this season were 13.91 per cent., or exactly the same percentage as for the season 1911-12. The averages for the different districts are as follows:—Western, 14.23; Gippsland, 13.97; N. & N.E., 13.91; City, 13.88.

It will be remembered that on 16th November, 1912, the Hon. the Minister for Customs issued a Proclamation altering the standard for moisture from 15 to 16 per cent.

The average moisture contents of the samples analyzed up to that date were 13.76 per cent., and since the date of that proclamation 14.02 per cent. There were 25 consignments found to be above the limit in moisture when the standard was at 16 per cent., and 13 consignments since the alteration, or a total of 38 infringements under this heading for the season, as compared with 131 for the previous one. This shows a satisfactory improvement in manufacture in the direction under notice.

Boric Acid.—Eight consignments, representing 411 boxes, were detained on account of excess boric acid, as compared with eleven con-

Weights.

I regret to say that the same satisfactory condition of affairs does not exist as regards weights. Under this heading contraventions occurred to the extent of no less than 167 consignments of butter being held up for either short or bare weight or both, as compared with 95 last season, thus showing an increase of 75 per cent. in the number of offences.

There is evidently a growing laxity regarding weights in some of our butter factories, and the managers should give attention to the matter without delay. Carelessness in the actual weighing or in the attention given to the scales is mainly responsible for this trouble, and whilst it is perhaps not a vital point in connexion with the quality of our butter, it is significant of a want of interest and attention on the part of those responsible that may make its appearance, in other phases of manufacture, with much more serious consequences. Apart from the amount of the penalties exacted by the Customs Department for those offences, and the expense incurred in weighing the whole consignment, and the purchase of butter to make up the weight, there is another and more serious aspect, namely, the effect on the quality of the butter. In warm weather, this butter has to be removed from the cool chamber for weighing, every box of the consignment has to be opened and tipped out on to the scales. Those that are short have to be made up to the correct weight, the butter used is in most cases not from the same factory, in all probability it is not of the same quality, and invariably of different colour, and finally, this work is done by persons inexperienced in butter factory work. Managers can imagine the effect such treatment and exposure will have on the appearance and neatness of the parcel, and when these patched-up boxes are opened up for examination, one is presented with a daub of butter on the top of each box of a deeper or lighter hue than the remainder of the contents. I feel sure that it is only necessary to bring the evils of this fault under notice to have immediate attention in future.

General Defects.

During the season under review, there were 150 exporting factories, which submitted for examination close on 10,000 consignments of butter: 50,000 boxes, representing 10 per cent. of the number of boxes presented, were examined, with the following result:—

Flavour.—3,416 consignments were penalized for staleness in flavour, 435 for metallic flavour, 362 for heated flavour, or a total of 4,213 consignments, representing nearly one-half of the whole, for defects in flavour.

Manufacture.—One thousand and seventy-three consignments were penalized for greasiness in texture, 606 for mottle, 522 for free moisture, 151 for milky or cloudy moisture, or a total of 2,352 consignments which were found to be suffering from defects in manufacture.

Of those referred to under the heading of "Flavour," managers can hardly be held wholly responsible, but the 2,352 consignments for which points were deducted for faults in manufacture must be placed at the doors of factory managers.

The lack of efficient refrigeration, or proper attention to temperatures, is chiefly responsible for these manufacturing defects, and I

would suggest an earnest effort on the part of managers to remove the cause of these complaints without delay.

Moulds.—Twenty consignments were found to be more or less badly affected with mould.

In many cases, the butter was transferred into other boxes and re-papered before shipment, on the recommendation of the officers of the Department. Many reasons are advanced as to the cause of moulds. I will not here enter into the various causes, but would suggest that proper steps be taken by our factories to prevent an outbreak of this infection. Mould cannot grow on an unseasoned box any more than it can on a seasoned one if the spores are not present. No factories are immune from attack, so that it is only by preventive measures that the trouble can be averted. Empty boxes and paper should be kept out of the way of infection, admit as much light as possible into your storerooms, and keep the factory free from moulds, and this trouble will cease.

It is only by close and constant contact with the produce from the different factories that one can realize the extent to which shortcomings in the process of manufacture are evident.

Directors and proprietors of butter factories should endeavour to permit their managers to visit the Cool Stores at intervals during the export season, so that they may note the faults in their product, and make comparisons with other factories' butters. By doing this, they would keep in close touch with the work of grading, and this would materially assist them in their duties at the factories.

There are many little points that may appear insignificant when written in a report, but when seen by the manager of the factory, would be regarded as important enough to warrant a change.

Shortcomings.

For the information of managers of butter factories I herewith submit a number of details, which I trust will have attention.

Advices.—Advice notes not infrequently reach the office after the butter is graded: in that case we have no information to guide us in selecting the churn marks, and in the various little details relating to the proper examination of the butter. Many of these advices are incomplete, not containing churn marks in a number of cases, or stating whether the butter is salted or unsalted, and if for export.

Churn Marks.—A very large proportion of the churn marks are indistinct, only a few of the consignments are marked on both ends, and some of the marks are entirely too small.

Boxes.—A small proportion of consignments arrive in a soiled condition, occasionally when boxes are turned out they are found to contain dust and light shavings, and soiled paper as a consequence. Some of the wire-bound boxes are badly closed, the ends of the wires projecting, thus causing injury to the men's hands, and damaged clothing. In other cases there are too many nails in the lids, and the nails are usually too long.

Paper.—Quite a number of boxes were found with mouldy paper, others factory stained, and some fly stained.

Finish.—Very few factories now make a neat and attractive finish. I think managers are becoming more indifferent as regards the

appearance of their butters, or it may be that the finishing rollers are getting dull and blunt, and this fact may have escaped the notice of the manager. I would strongly advise that more attention be given to the finish and neatness of the boxes.

Rivalry Wanted.

Agricultural Shows.—There is another matter that I would like to bring under notice, and that is the question of exhibiting at shows, more particularly from my point of view the classes for Colonial butter at the British Dairy Farmers' Association, who are good enough to provide classes expressly for Colonial exhibitors. Appreciation should therefore be shown by being suitably represented both as regards quantity and quality. It must be remembered that England is the centre and hub of this market, and any efforts by us that are put forward to make that exhibition a popular and successful one must materially assist in advertising our produce.

Other States of the Commonwealth are now turning their attention towards securing these honours, and, in fact, have been successful during the past two or three years in snatching from Victoria the pride of position which she held for years.

It was my privilege to be selected to judge the butter exhibits at the recent Sydney Royal Agricultural Society's Show, and my surprise can be imagined on arriving there, to find myself confronted with an array of butter, consisting of 101 separate exhibits, comprising 155 boxes. On comparing this with the number of exhibits at the last Melbourne Royal Show, which consisted of 23 exhibits all told, I was at a loss to understand the reason. I find the value of prize money is as good in Melbourne as in Sydney, and the entrance fees are lower. Should there be any objections to competing amongst Victorian exhibitors, I feel sure the Council of the Royal Society of Melbourne will endeavour to remove it on being made acquainted with the fact. At the Sydney Royal Show, Queensland and Tasmania were represented by exhibits, but Victoria was absent. I was twitted with this fact by New South Wales managers.

I had some valuable discussions with many of the exhibitors, and was pleased to note a tone of enthusiasm and rivalry in regard to their exhibits. That an exhibition of this sort has its educational side is fully acknowledged by the New South Wales managers, and I understand it is their intention to combine with their Managers' Conference, which is to be held some time in June next, an extensive butter competition.

I think this is a matter deserving of consideration, and I trust that the result will be such that when the cable comes to hand notifying the successful exhibitors at the next Islington Show, that Victoria will not be relegated to the background, and that officers of the Department will not be called upon to invent some ridiculous and feeble excuse to account for the inferior positions occupied by our factories on the prize lists of that exhibition.

I feel that there are many points of importance that have been omitted in this paper, and I trust that inquirers will not be backward in seeking fuller information on these various matters, and I will endeavour, as far as lies in my power, to supply the information.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 404.)

PART V.—THE LEMON.

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

Lemons.

A fruiting branch of the lemon is shown at *C*, Plate 28. The fruit is borne on the terminals, axils of the leaves, or any bud brought into activity on the tree. *D* shows the lemon leaf. *E* the petiole. *F* the articulation. Lemon trees require guiding up to the age of three years after planting. They should then be pruned to form a tree more open in the centre than the orange. They can be pruned to the semi-open centre, as shown at Plate 28*a*, where the cuts are indicated by

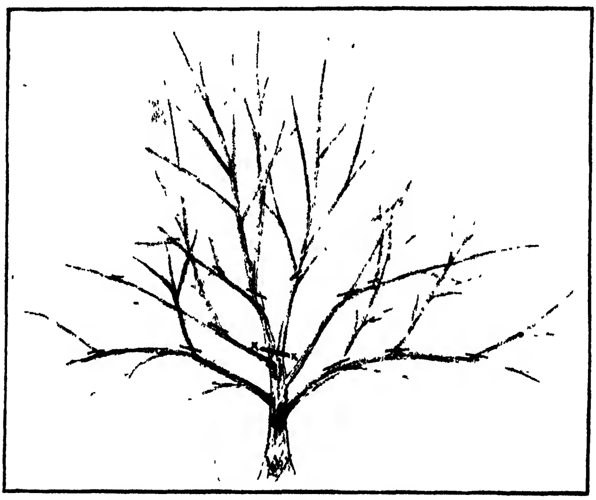


Plate 28a.—Method of Pruning.

the lines ——, or they may be pruned to the direct open centre, as shown by the lines —— and x ——x. If adopting the latter system, which is shown in Plate 28*b*, four well-grown leaders should be selected, equally spaced around the tree, and the strong central growth removed, also any uprights. These selected leaders should be horizontalized as much as possible, and this will have the effect of producing vertical growths. From each of these verticals two should be selected, situated as near the centre of the tree as possible (well spaced), on each of the four leaders, and be allowed to grow for two years, the other growths being either subdued or removed. At the end of two years, or when a strong growth has been made, the vertical strong growth should be removed, by cutting back to a strong lateral, one having an inclination to the right, and the other an inclination to the left of the branch on which they are growing. From these horizontals other verticals will be produced; one should be selected on

each right and left horizontal, and allowed to remain for two years, and at the end of that time, or when a sufficiently strong growth has been made, these verticals should be shortened back to a strong horizontal lateral, having a direction the same as the leaders selected

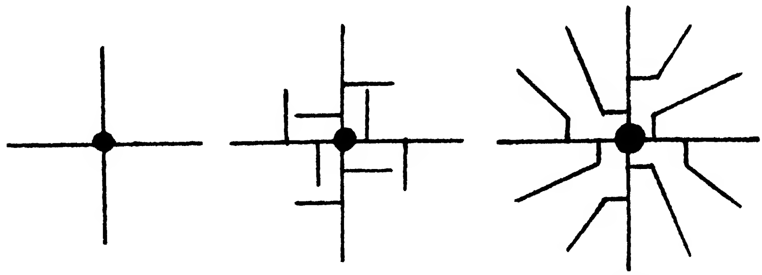


Plate 28B.—Method of Pruning.

at three years of age. The tree will now be seven years of age, and should be about 8 feet high, open in the centre, and clothed all over with fruiting wood accessible in every part, and have a thoroughly symmetrical frame, consisting of twelve leaders, the right and left

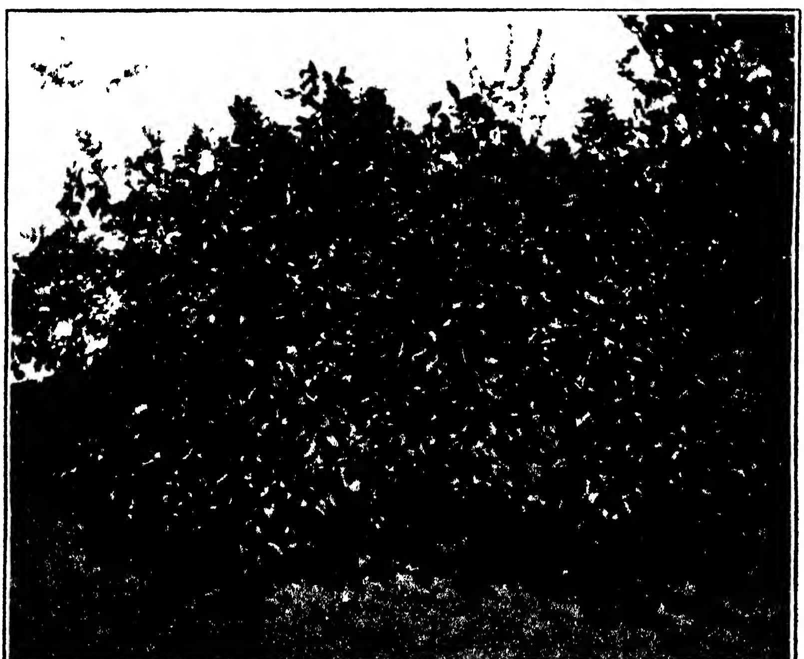


Plate 29.—Lemon tree pruned to the open centre, White Hills, Bendigo.

inclined horizontals having been shortened back. The tree will be built up of strong wood, branched and arranged at different angles. When the tree is in shape, strong central upright growths, which will have a tendency to crowd the centre, should be removed, and should any further addition to height or new leaders be required, it is easily

brought about by allowing well-placed verticals to remain, and be treated the same as when the tree was being formed.

Another method of keeping the open centre is by pruning to form sturdy branches, throwing them to the horizontal at intervals by removing a vertical leader, where a strong horizontal grows from it, as shown, Plate 28*a*. A vertical growth results again from the horizontal, and this, in turn, is treated similarly until the tree is of sufficient height. Lemons will stand hard pruning, and open centre arrangement, but care and attention is required to keep the tree relieved of superfluous upright central growths. Allow only weak

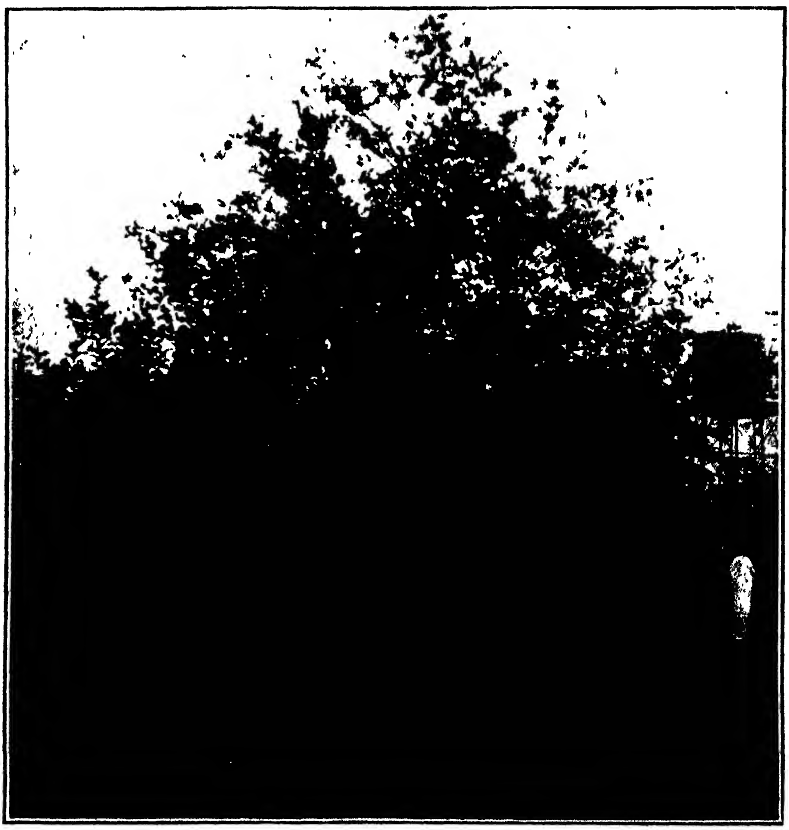


Plate 30.—Dome-shaped Lemon Tree unpruned from time of planting.

verticals, or horizontally-placed laterals, to fill in for the supply of fruit. This type of tree produces an even class of fruit, almost free from culls. Plate 29 represents the type of tree, diameter 14 feet, height 9 feet. The fruiting surface of this tree is considerable, as it bears right through from the centre to the outside leafage, and is the type of tree to be aimed at. Plate 30 shows the lemon tree too frequently seen. The tree has been left unpruned throughout its career, and has produced spindly wood of vertical character. The tree is devoid of fruit in the centre, and along the weak verticals. Sap

growths, or robber shoots, have been allowed to form, and remain at will, and the tree generally has led a wild, extravagant career. The quantity of culls from a tree of this description is very great. The fruit is uneven in size, and generally scratched and injured by the effect of wind lashing the weak spindly growths. Plate 31 shows the framework of such a tree. A strong central robber growth is marked at ——, and other vertical robber growths at ——; the tree is dense centred, and fruits practically on the outside surface foot only. Plate 32 shows the robber growths removed, and the tree pruned to semi-open centre, and Plate 33 shows the tree pruned to more direct

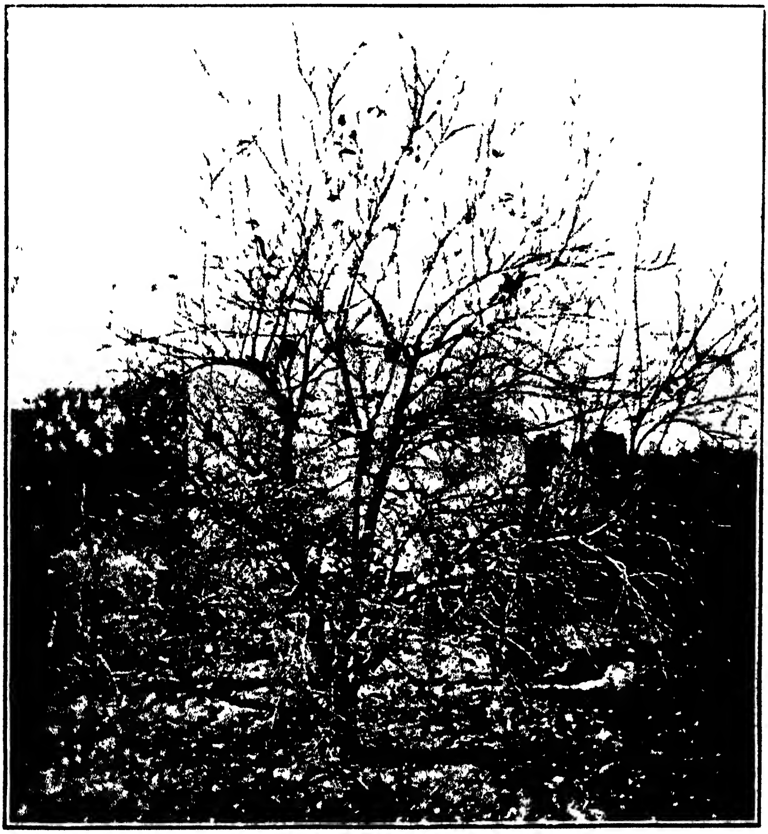


Plate 31.—Framework of unpruned Lemon Tree ten years old.

open centre on the same system as Plate 29. In Plates 32, 33, there has been no attempt to prune to show lateral arrangement, only to show the open centre ——.

The orchard must be made profitable, consequently, pruning should be thoroughly carried out. A tree 20 feet wide and 12 feet high is more profitable than a tree 12 feet wide and 20 feet high. Step-ladders are not a necessity in a properly-trained lemon grove. The grower should always be master of the tree, therefore, the tree should be always under control. The flow of sap should be led and distributed

equally all over the tree. The branches should be covered with elaborated growth from their base to their extremities, and held in

Plate 32.—Lemon Tree pruned to show semi-open centre and removal of sap growth.

absolute control. The extremities of the highest branch should be within reach from the ground. Upright growths make only for wood,

Plate 33.—Lemon Tree pruned to more direct open centre.

and on a vertical shoot the elaboration of sap is greatest at the top, while there is extensive sap elaboration all along a horizontal growth,

and as there is no fruitfulness without this elaboration, a horizontal form must be aimed at. Angles and turns in the branches, made up of wood of different ages, prevent rushes of sap, and force small growth of a fruiting character. Branches should be constructed so that they can support the weight of foliage and fruit without propping. If there is strength at the base, and the growth equally distributed, there will be little necessity for props. Upright limbs exhaust the vitality of the tree; bend them down, and they will produce fruit. Build for the horizontal, and keep to the horizontal, and the lemon will repay you. In orange and lemon pruning remember the tree will be prolific just in the same ratio as you care and attend to it. Study the habits of the tree, and you will become its master.

(*To be continued.*)

COMPETITION IN CEREALS—

The number of plants developed from a bushel of wheat is never equal to the number of grains in a bushel. With good seed nearly the whole may germinate, but subsequently a number will die off owing to competition and other causes. A suggestive investigation bearing on this subject is reported from the University of Nebraska (*Sta. Bul.* 127). Wheat and oats were employed. Seeds were planted at ¼, ½, 1, 1½, and 2 inches in rows to find how many plants survived competition. With the thinnest planting 75 per cent. survived, and with the thickest 56. Next, plump and poorly-developed seeds were alternated in the same row, and of the former 72 and of the latter 62 per cent. attained to maturity. With plump seeds all in one row 65 per cent. survived, and with a row of poorly-developed seeds 60 per cent survived. Two points of direct practical interest emerge from these tests. Pure strains of seed are desirable, because the variety which when sown alone is the best yielder may be dominated by a less productive type in a mixed sowing. The other point raises the value of thick sowing as a natural method of eliminating weak plants from a variety. Plants may die from other causes than competition, but competition is a powerful means of separating the weaklings. It is suggested that thick seeding may do more to improve the variety than seed dressing and grading. This may be open to question, but the line of argument is suggestive. In England it is usual to drill wheat at the rate of 2 to 3 bushels per acre, and here elimination of weakly plants by competition must be great, leading to a strengthening of the type. In Victoria, owing to climatic conditions, it would usually be disastrous to seed at the English rate; and it may be owing to this necessity for thin seeding that some of our best Australian wheats show a strong tendency to degenerate under continued cropping.

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STANDPOINT.

PART IX.—OVER-SEA TRADE—DISTRIBUTION AND MARKETING—*continued.*

(*Continued from page* 397.)

By E. Meeking, Senior Fruit Inspector.

Trade Expansion.

Although the over-sea fruit export trade during the past decade has, on the whole, expanded more rapidly than the export trade in other classes of products, it is particularly in connexion with the export of fruit to Germany that the development may be considered as phenomenal. The trade to that country began as recently as 1904, in which year a total of 5.250 cases were exported. The following figures will show how rapid the expansion has been and how great has been the development in comparison with the export to other countries:—

Country.	Year.	Quantity.	Proportional Increase.	Proportional Decrease.
		Cases.		
United Kingdom ..	1904	61 287	3·04	
	1913	186,449		
Germany	1904	5,250	32·28	
	1913	169,505		
South Africa ..	1904	15,250	..	·19
	1913	12,519		
East	1904	5,999	1·22	
	1913	7,339		

The above figures show that the development of the trade with Germany has been nearly thirteen times greater than the combined total expansion with other countries. This would seem to show that, at any rate, under the present methods of marketing the limit of expansion has been more nearly reached in the other countries under notice than is the case with Germany. This is emphasized by the fact that, notwithstanding the rapid growth of the trade to Germany, higher prices are still being obtained for our fruits on the Hamburg and Bremen markets than are realized on the markets of London and Liverpool. There is good reason for believing that no decrease in the demand for our fruits in Germany is likely to take place in the near future, but that with wider and more complete methods of distribution than are at present in vogue the trade with Germany may be indefinitely expanded. At present Hamburg is the chief distributing centre, but

some of our leading exporters to Germany consider that the port of Bremen would, if utilized to the extent which its central position justifies, prove equally as efficient from a distributing point of view as the port of Hamburg, as Bremen possesses direct communication with the large cities of Berlin, Essen, Dusseldorf, Cologne, Frankfort, Mannheim, Hanover, Magdeburg, Leipsic and Dresden.

WIDER DISTRIBUTION IN GERMANY NEEDED.

As showing the advantages to be derived from shipping direct to centres other than a single distributing centre, it may be pointed out that advices have been received, as this article goes to press, from a leading firm in Hull, stating that the first direct shipment of Tasmanian apples to that port realized the following prices:—

Cleopatras, 12s. 6d. to 13s.
Scarlet Pearmain, 11s. to 11s. 3d.
Jonathans, 14s. to 15s.
Sturmers, 10s. 6d. to 11s. 6d.
French Crab, 10s. 6d. to 12s.
Adam's Pearmain, 11s.
Other varieties, from 10s. 6d. upwards.

The advice further states that "the demand was very keen, and every box was sold. By these prices you will see that we can handle apples equally as well as the best ports in the United Kingdom, and as Hull charges are lower than London, we think shippers would often do more profitable business to ship their goods to Hull. We think this sale constitutes a record in the aggregate for any cargo of Australian apples, and clearly proves that we are able to handle the goods to advantage."

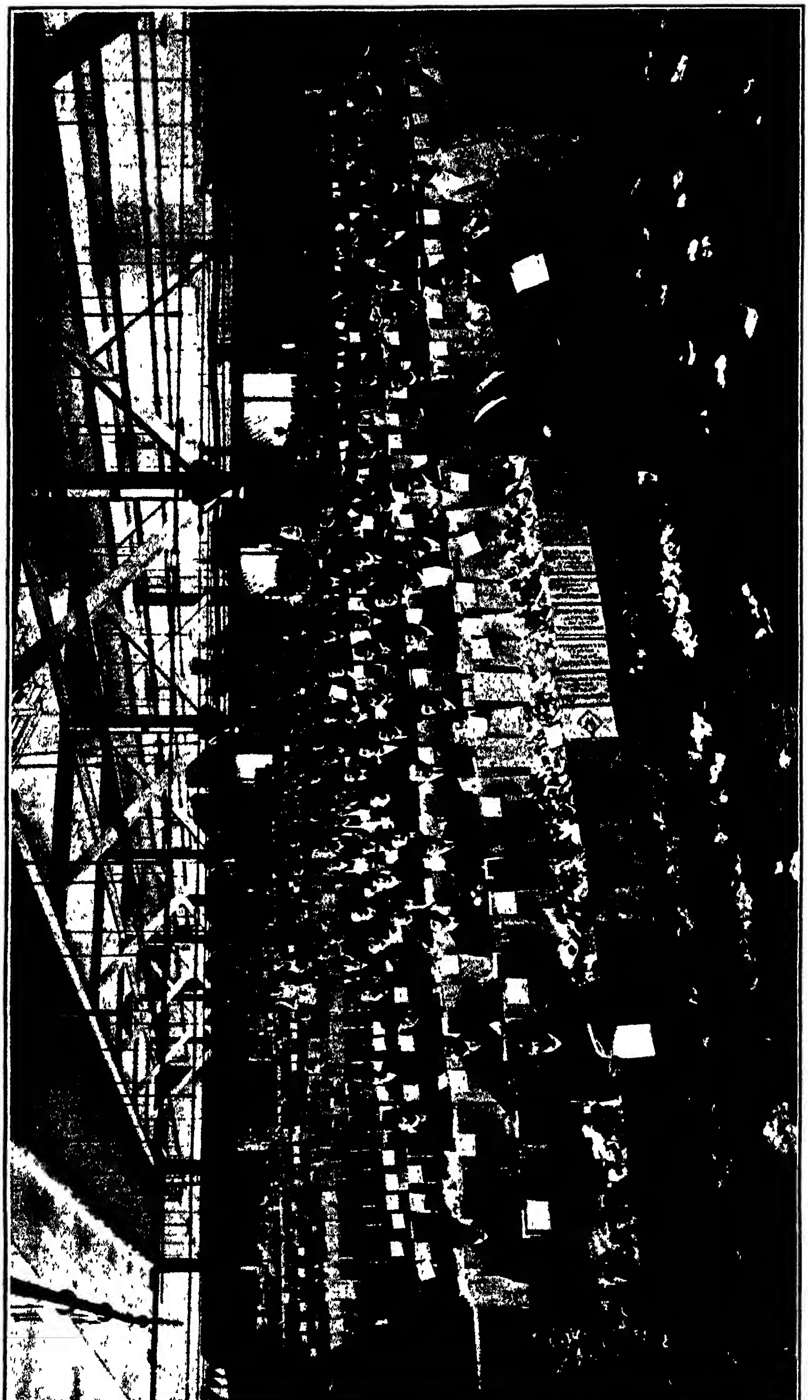
The shipment referred to comprised 12,500 cases.

The same arguments which apply to the opening of new centres in the United Kingdom for the sale of our fruits apply also to Germany, as the realization of good prices is more likely if our fruits are sold from several centres, each competing with the other, than if sold at a single centre for subsequent distribution.

The matter of establishing cool storage depôts at such centres as Hamburg and Bremen similar to the proposed erection of a depôt in London is a matter that may be worthy of attention.

HAMBURG AND COVENT GARDEN METHODS COMPARED.

One of the chief reasons for the enhanced prices obtained in Germany over those which our fruits command in the United Kingdom is no doubt due to superior methods of displaying consignments in the inspection rooms at German ports prior to auction. Under the arrangements carried out in Covent Garden, buyers do not possess the same facilities for judging the merits of consignments as is the case in Germany. In Covent Garden, a consignment is often sold on the appearance of a single case. In Germany, the consignments are completely exposed for the inspection of intending buyers the day before auction. This enables the buyers to exercise their judgment and mark



HAMBURG APPLE MARKET.

their catalogues in accordance with their observations. The system is shown in the accompanying illustration of the interior of an inspection shed at Hamburg. When the fruit is auctioned later, the buyer under this system knows exactly the price he considers he should offer for each consignment. This matter has been mentioned before in previous numbers of the Journal, but it is considered of sufficient importance to justify a repetition.

In addition to the markets of the United Kingdom and Germany, it must not be forgotten that the question of opening a trade with other European countries than these should be seriously considered.

Possibilities of Trade with America.

Speaking generally, the European Continent may be considered up to the present, as practically untouched by our fruit exporters. In addition to the United Kingdom and Europe, good markets exist on the North and South American continent for our fruits. The chief difficulty in the matter of opening these up lies in our present inadequate shipping facilities. The Argentine Republic has proved, during the past two years, an exceptionally good market for Tasmanian fruits. Hobart possesses the advantage of a direct steam-ship service with the port of Buenos Aires, and all available space is booked by the Tasmanian growers. Even were this not so, however, shipments to Buenos Aires from Melbourne would, under present conditions, require transhipment at Hobart, and transhipments in connexion with transportation of fruit over long distnces is objectionable from many points of view. On the North American Continent, profitable markets exist at Vancouver, San Francisco, and the cities along the Atlantic seaboard, but, in the absence of direct steam-ship service, the same difficulty exists in reaching these as is the case with shipments to Buenos Aires. There seems little doubt, however, that before long a direct service to San Francisco and Vancouver will become established. The opening of the Panama Canal also should bring the cities of the United States within measurable distance of Victorian shippers. The recent decision by Congress to lower the Tariff on raw products imported into the United States should, when in operation, be a potent factor in assisting to open up a profitable trade between the Commonwealth of Australia and that country. If we desire to establish a trade with the North American Continent it will be essential that our fruits be put up under methods which have been in vogue in Canada and the United States for some years past. These methods provide for the packing of apples and pears under what is called the diagonal-numerical system. This has become so firmly established on the North American Continent that fruit put up under any other method does not command a ready sale The system will be fully explained in the following and subsequent articles.

(*To be continued.*)

TOMATO CULTURE IN VICTORIA.

(*Continued from page* 440.)

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

Irrigation and Cultivation.

The tomato is not a deep-rooting plant, and the leaf surface is large in comparison with its root surface. Evaporation from the leaves is considerable, and this, combined with its shallow feeding qualities, renders it necessary that frequent waterings should be given. Cultivation can be practised in the early stages of field growth with considerable ease, consequently, surface mulching will break up the capillary tubes and arrest evaporation, and hold the moisture in the soil at the height required for the plant. Later on, as the plant enlarges, cultivation cannot be so easily carried on. Evaporation from the untilled surface is increased, and more water is necessary for the requirements of the plant. To reduce this increased evaporation, it will be found a good plan to half fill the furrows with a mulching of straw manure. This arrests evaporation to a large extent, and also places food within reach of the plant. Various implements are used in cultivation. For furrowing and hilling, a reversible mould-board plough is used, or a home-made implement, called a "ditcher," having a mould-board on each side. For cultivation in the furrows after planting, a five-tooth cultivator is generally used, and for the purposes of hand labour the Spanish hoe is the most suitable. The general practice is to irrigate once a week during dry weather, allowing just sufficient water to fill the furrow or furrows. The furrows are then blocked, to hold the water, either singly or in groups, according to fall in the surface; the idea in irrigating tomatoes being to give every plant an equal share of water. In Plate 5, the system of irrigation is grouped into four furrows. The water is held in check in the distributary furrow at + by earth banked across the fall. the water flows along the lateral furrows, as indicated by the arrows, and when all the furrows in the group marked A are filled, watering the ridges 1, 2, 3, 4c. The bank across the distributary furrow is removed to the inlet of the first lateral furrow marked —, this holds all the water in this group, and the stream passes on down the distributary furrow to the next earth check + where it waters the group marked B. This group is then checked by removing the earth from + to — and the water passes on to the next check + and waters the group C. This is checked similarly to A and B, and the water passes on to the next check + and waters the group D, and so on if the sections are longer. The alternate groups E, F, G, are watered on the return. Supposing D to be the last group to be watered on the downward journey, the check + is not removed, but the check + in the first furrow of group E is removed to — across the distributary furrow, and when all the furrows of that group are filled the check + in group F is similarly treated, then group G, and then the water is shut off at the distributary channel, and passed on to the next distributary furrow marked K; this is similarly watered, and so on the whole field is irrigated. This

system can be worked to any number of furrows, according to the fall. If the fall be very slight, a great number of furrows in a group; if fairly steep, every other furrow is watered on the downward passage of the water, and the remaining ones on the backward journey. On very steep slopes the surfaces may be terraced, and the distributary furrows brought along the contour. The Chinese adopt the system described, working on flat surfaces. The main distributary channel is a permanent one in the centre of the path, as described under "Planning Surfaces," and shown in Plates 1 and 5.

Under the system shown in Plate 7, an advantage is gained by using a large volume of water at one time. The distributary furrow is much larger than the lateral furrows. The water is brought along the distributary furrow to the end of the section, and spreads right and left along the lateral furrows, indicated by the arrows. This system is adapted to large areas on almost level surfaces. Should blocking in the distributary furrow be necessary to hold the water to any required level, temporary checks can be placed wherever necessary, by using a piece of canvas attached to a bearer of wood, and placing it across the distributary furrow. The furrows marked A may be used as drainage furrows in the event of heavy continuous rain, or alternately as distributary furrows.

Plate 8 shows the distributary channel brought along the level with the lateral furrows following the fall. Under this system lateral furrows may be watered singly or in groups, according to the volume of water used. If singly, then the earth check + in the distributary channel is turned back to — in furrow No. 1 after that has been filled or thoroughly saturated, this will depend on the fall and length of furrow; then No. 2 is similarly treated, and so on the water is passed along until the end furrow is reached. If watering in groups from a larger channel marked A, then the checks + are placed according to the number of furrows that will carry the volume of water passing through B at one time. These checks can be permanent, each group being served by an independent outlet, as shown. This system may also be worked in the opposite way, bringing the distributary channel down the fall and placing the lateral furrows along the level.

Packing and Marketing.

The tomato plantation should be picked over every day when the fruit begins to ripen. In picking for market the fruit should not be gathered until it shows pink on the blossom end. The fruit should then be taken to the packing shed, and assorted and packed according to its degree of colour: "Ripe," "Medium Ripe," "Green." All culls should be fed to stock or destroyed. Of these three grades, firsts and seconds should be made, making in all six grades—

Ripe	Grade No. 1
"	" " 2
Medium ripe	" " 1
" "	" " 2
Green	" " 1
"	" " 2

Factory tomatoes need not be graded, but greater care should be exercised with regard to the quality of the fruit supplied.

The case used for transport is the long bushel case, and is generally adopted throughout the State. Separate wrapping of the fruit is not practised, but the cases should be lined with paper on the bottom and sides, and folded over on the fruit on the top after it is packed, and before the lid is nailed on. Packages should all be labelled with the name of the grower and the district, also the grade of fruit contained. In sending tomatoes over long distances special cool trucks should be used, and it is not advisable to send " Ripe " grade under any other method. To many growers these suggestions may seem somewhat extravagant. The present crude and slipshod method of handling tomatoes for market is not conducive to the best interests of the producer, and there should be just as much care taken in placing this fruit on the market as there is in placing peaches or any other dessert variety of fruit.

(To be continued.)

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

Monthly Report Ending 14th July.

The weather of the month under review has been of a somewhat mild nature compared with that of the last month, the morning temperatures on only six occasions falling between 33 and 39 degrees.

Drizzling rain fell for several days in succession, the rainfall for the month being 143 points.

Extremely cold winds blew on occasions, and one day a temperature of only 54 degrees at mid-day was registered.

Although the climatic conditions were severe, egg production has increased by 386 eggs over the same month of the previous competition, the totals being 5,688 eggs last year against 6,074 eggs for the present competition.

The feeding was similar to that of the former month in the morning, but at mid-day a slight proportion of maize meal was given, while at night the ration consisted of wheat 4 parts, cracked maize 3 parts, and occasionally 2 parts stout white oats. In the wet weather more maize than wheat was given. The pens that went into moult have started to lay, as have also the backward ones; still, there is room for improvement in them. The leaders of last month (Pen 6, Spotswood) have fallen back into third place (one hen being in moult), the second pen (No. 23, Gill) is now in the lead with a grand total of 381 eggs. Pen 65, Lawson, has moved up into second place.

The general health of the birds is excellent, all being bright headed, alert, and eager for their food. All traces of the mild form of chicken-pox have disappeared.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen	Breed	Name of Owner.	Eggs laid during Competition: April 15 to June 14	June 15 to July 14.	Total to date—3 months	Position in Competition.
23	White Leghorns	J. H. Gill	242	139	381	1
65	"	E. A. Lawson	237	124	361	2
6	"	J. S. Spotswood	257	101	358	3
61	"	Jno. Campbell	228	122	350	4
48	"	Thinkell and Smith	212	130	342	5
8	"	E. H. Bridge	217	117	334	6
11	"	C. J. Beatty	209	124	333	7
46	Black Orpingtons	T. W. Coto	210	115	325	8
21	White Leghorns	A. Ross	213	109	322	9
68	"	Jones and Curtis	197	116	313	10
31	"	W. G. Swift	203	106	309	11
16	Black Orpingtons	D. Fisher	189	117	306	12
50	White Leghorns	A. H. Mould	200	103	303	13
10	"	T. A. Pettigrove	177	125	302	14
34	"	J. E. Bradley	181	120	301	15
35	"	Moritz Bros.	181	109	290	16
66	"	W. Featherstone	191	92	283	17
7	"	H. McKenzie	160	115	275	18
37	"	C. H. Busst	174	100	274	19
40	"	Geo. Edwards	175	97	272	20
49	"	M. H. Noye	174	97	271	21
47	"	W. McLister	179	91	269	22
2	"	R. W. Pope	183	78	261	23
14	"	F. Hannaford	173	85	258	24
43	"	Morgan and Watson	135	119	254	25
32	"	H. Hanbury	168	84	252	26
63	"	A. Sellers	162	86	248	27
39	"	W. Purvis	144	104	248	
20	"	C. B. Bertelsmeier	144	102	246	29
41	"	Percy Walker	154	91	245	30
26	"	B. Rolls	139	105	244	31
38	"	M. A. Monk	152	89	241	32
25	Black Orpingtons	King and Watson	133	107	240	33
67	White Leghorns	C. Hepburn	122	115	237	34
58	"	Stranks Bros.	137	98	235	35
45	"	D. Goudie	161	74	235	
13	Black Orpingtons	T. S. Dallimore	116	117	233	37
24	White Leghorns	Redfern Poultry Farm	132	98	230	38
18	"	B. Rowlinson	148	79	227	39
27	"	J. Sinclair	147	78	225	40
5	"	G. W. Robbins	103	110	213	41
3	"	S. Buscumb	143	69	212	42
59	S. C. White Leghorns	Cowan Bros.	136	68	204	43
22	White Leghorns	B. Mitchell	107	94	201	44
55	"	P. H. Killeen	97	94	191	45
52	"	W. G. Osborne	95	88	183	46
28	"	E. Waldon	120	62	182	47
53	Black Orpingtons	A. Greenhalgh	133	49	182	
62	White Leghorns	G. A. Gent	123	54	177	49
57	"	Gleadell Bros.	91	74	165	50
17	R. C. Brown Leghorns	S. P. Giles	88	76	164	51
12	White Leghorns	A. H. Padman	78	78	156	52
19	"	W. Dunlop	88	66	154	53
44	"	W. A. Rennie	89	63	152	54
33	"	South Yan Yean Poultry Farm	54	97	151	55
42	"	A. Stringer	58	90	148	56
56	"	Schaefer Bros.	55	87	142	57
51	Black Spanish	W. H. Steer	41	80	121	58
36	White Leghorns	A. J. Jones	51	67	118	59
15	"	J. Shaw	47	62	109	60
54	"	Jas. McAllan	26	73	99	61
64	Golden Wyandottes	C. L. Sharman	35	62	97	62
30	Black Orpingtons	Jas. Ogden	42	52	94	63
29	White Leghorns	S. Brundrett	30	59	89	64
9	"	Sylvania Stud Farm	34	44	78	65
60	Black Spanish	Watson and Rushworth	12	47	59	66
4	White Leghorns	Jas. Brigden	25	32	57	67
		Total	9,057	6,074	15,131	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

The work of pruning should be completed before the end of August. This is particularly necessary this year, as every indication points to an early spring. The winter in June and July has been a very mild one; and in several districts, even at the middle of July, it was observed that the buds of various fruit trees were showing signs of sap movement, and were swelling and changing colour.

For this reason, if the winter spraying has not been carried out, it should be done without delay. One of the most general winter sprays is red oil. The caustic properties of this oil are well known; and in order that no damage will arise from burnt buds, it is advisable to finish the red oil spraying immediately. Once the buds commence to move, all oil preparations should be kept from the trees. It has previously been stated that a strength of 1 in 30 of red oil is amply sufficient to destroy such pests as bryobia mite, scale insects, and woolly aphis; when the oil is used late in the season, it certainly should not be sprayed at a greater strength than this. Red oil may be emulsified by combining it with soft soap, using 1 lb. of soft soap to 1 gallon of oil; or it may be used in combination with lime, using 1½ lbs. of lime, dissolved in water, to 1 gallon of oil, afterwards reducing this down with 30 gallons of water. Many of the red oils now sold are in a prepared form, the oil merely requiring the addition of a small proportion of washing soda to the water before mixing. Crude petroleum or kerosene may also be used in an emulsified form for a winter spray, but general practice has shown that the red oil is the superior of all oil emulsions.

A watch will need to be kept for peach aphis, which makes its advent in the spring. This insect multiplies so rapidly, once it does appear, that, on the first indication of its presence, the trees should be sprayed with a strong tobacco solution. They should be examined on the day after spraying, and if any aphides are still alive, another spraying should be given.

A vigilant watch, and constant sprayings in the early season, will check this pest and will be the means of saving much time next month when it will be urgently needed for other works. Peach, almond, and Japanese plum trees are attacked by the peach aphis. This is also the season when the bryobia mite (red spider) is hatching and breeding. If the trees have received an oil emulsion in the winter, no danger may be feared from this mite. But if not, then an effort must be made to keep it in check by spraying the trees with strong nicotine solution or with one of the proprietary mixtures now on the market. The foliage and young buds are greatly damaged by the attacks of this mite, and so to allow full leaf action, it should be attacked before the flowers or foliage come.

The work of planting will also require to be finished before the end of the month. Indeed, it is not advisable to defer planting even so late. It has often been advanced by growers that late-planted

peaches thrive far better than early-planted ones; but it is well to get the trees in as early as possible, in the event of the season setting in early.

Preparation should now be made for planting orange and lemon trees. These may be lifted and planted out as soon as the season sets in warm; but the soil should be thoroughly drained and sweetened before these trees are planted in their permanent positions. No trees require so thoroughly an aerated soil as the citrus family; and, to insure successful growth, the ground should be placed in good heart before planting. Although the planting of this class of fruit trees may be delayed until midsummer, it is advisable to plant them as soon as the soil is warm enough to induce new root growth, so that they may thoroughly establish themselves during the first season.

Vegetable Garden.

The work in this section during the month of August is comparatively light, provided that it has previously been kept up to date. The soil should be mellowing and sweetening, in anticipation of the planting of the main crop in a little while.

Seeds of lettuce, tomato, cabbage, peas, radish, and broad beans may now be sown. Potatoes may be planted out. Where a frame and hot-bed are in use, celery, cucumber, vegetable marrow, tomato, and pumpkin seeds may be planted.

All seedlings ready for planting out, such as cabbage, cauliflower, onion, and lettuce, may now be planted in the beds. Herbs of all descriptions should be sown.

Flower Garden.

Rose pruning should now be completed. At this time the buds are beginning to swell and show some prominence, and no check should be put in the way of their full development. A careful watch should be kept for the appearance of aphis, which should be washed off as soon as it is noticed. It is advisable to have a specific always on hand, ready made up, so as to kill the aphis when noticed. The aphis is a very rapid breeder, and delay of a few days means an enormous increase of this pest. Quite a number of specifics are useful in combating the aphis—soaperine, tobacco emulsion, strong soapsuds, Robinson's pine spray, and pestend solution are among the useful remedies. Whatever is used, a good application should be given, and it should be repeated at frequent intervals, if the aphides remain.

All herbaceous and similar plants may now be planted out in the beds; these include delphinium, cannas, shasta daisy, rudbeckias, salvias, perennial phlox, &c. These plants should be well fed, so as to allow them to make a rapid and vigorous growth.

Weeds will need frequent attention, as they must be kept in check at this time of the year; they should be prevented from seeding in the beds.

The planting out of shrubs may now be continued and completed as early as possible, so as to allow the roots to get a good hold of the soil before the hot weather sets in. Gladioli may be planted for early flowering, and as well, a few divisions or tubers of dahlias.

Perishable and Frozen Produce.

Description of Produce.		Exports from State (oversea). Quarter ended 30.6.13	Exports from State (oversea). Quarter ended 30.6.12	Deliveries from the Government Cool Stores. Quarter ended 30.6.13.	Deliveries from the Government Cool Stores. Quarter ended 30.6.12.
Butter	lbs.	2,240,200	625,184	2,828,392	874,664
Milk (dried)	cases	1,690	2	..	..
Milk (concd.)	"	22,336	148	119	1,205
Cheese	lbs.	39,000	26,040	56,480	4,800
Ham and Bacon	"	8,400	38,520	...	
Poultry	head	13,605	3,705	176	2,224
Eggs	dozen	.	..	33,261	25,149
Mutton and Lamb	carcases	168,173	171,469	1,170	11,520
Beef	quarters	6,094	3,397	118	230
Veal	carcases	1,561	777	...	65
Pork	"		287	252½	820
Rabbits and Hares	pairs	626,058	183,444	117,876	130,361
Sundries	lbs.	.	.	85,215	24,316

8th July, 1913. R. CROWE, *Exports Superintendent.*

Fruit, Plants, Bulbs, Grain, &c.

Imports and Exports Inspected for Quarter ending 30/6/13.

Description of Goods	Imports. Inter-State.	Imports. Oversea.	Exports. Oversea.
Apples	190	—	104,264
do. (custard)	71	—	—
Bananas, bunches	29,116	73,410	—
do. cases	2,412	29,000	—
Barley	33,826	1	—
Beans	146	891	1
Blackberries	259	—	—
Bulbs	3	40	136
Cherries	—	—	329
Chillies	—	71	—
Cocoa beans	—	2,610	—
Cocoanuts	21	756	—
Coffee beans	—	2,749	—
Copra	—	3,214	—
Fruit—			
Canned	—	—	2,919
Dried	—	7,139	16,472
Mixed	3	6	—
Grapes	1	—	5
Green Ginger	6	594	—
Hay	—	513	—
Hops	—	368	—
Jams, Sauces, &c.	—	—	1,238
Lemons	956	76	1,284
Lentils	—	129	—
Limes	16	—	—
Logs	9	2,000	—
Linseed	—	1,123	—
Maize	4,390	133	—
Melons	—	—	9
Nutmegs	—	330	—
Nuts	294	2,335	—
Oat Hulls	829	—	—
Oats	2,777	492	—
Olives	10	—	—
Oranges	47,540	809	134
Passion Fruit	236	—	3
Paw Paws	3	—	—
Peaches	—	—	20
Pears	5	1	6,454
Peas, dried	9,788	30	—
Pepper	—	428	—
Persimmons	—	—	30
Pineapples	8,334	—	191
Plants, Trees, &c.	333	171	441
Plums	—	.	5
Potatoes	48	.	1,418
Quinces	—	—	2
Rice	4,782	148,363	—
Seed	1,317	14,357	49
Spice	—	6 1	—
Tomatoes	16	—	—
Vegetables	678	290	5
Wheat, Grain, &c.	93	—	—
Yams	192	1	—
Grand Totals	148,700	293,061	135,409

Total number of packages inspected for quarter ending 30th June, 1913 = 577,170.

11th July, 1913. E. MEEKING, *Senior Fruit Inspector.*

Rainfall in Victoria.—Second Quarter, 1913.

Table showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with the corresponding monthly and quarterly averages for each Basin, deduced from all available records to date.

Basin or District.	April.		May.		June.		Quarter.	
	Total.	Average.	Total.	Average.	Total.	Average.	Total.	Average.
	points	points.	points.	points.	points.	points	points	points.
Glenelg and Wannon Rivers	37	217	31	281	96	349	164	847
Fitzroy, Eumerella, and Merri Rivers	108	251	276	318	127	365	511	934
Hopkins River and Mount Emu Creek	132	204	208	253	122	299	462	756
Mount Elephant and Lake Corangamite	79	201	196	240	127	269	402	710
Cape Otway Forest ...	181	324	414	399	193	451	788	1,174
Moorabool and Barwon Rivers	100	209	320	233	168	263	588	705
Werribee and Saltwater Rivers	125	193	280	209	193	242	598	644
Yarra River and Dandenong Creek	217	307	245	311	211	374	673	992
Koo-wee-rup Swamp ...	166	305	411	308	206	377	783	990
South Gippsland ...	246	384	439	311	289	418	974	1,113
Latrobe and Thomson Rivers	204	293	446	282	279	377	929	952
Macallister and Avon Rivers	131	163	382	153	393	250	906	566
Mitchell River	98	211	418	227	484	280	1,000	718
Tambo and Nicholson Rivers	86	165	510	190	564	255	1,160	610
Snowy River	149	226	509	270	606	404	1,264	900
Murray River	35	136	301	178	173	268	509	582
Mitta Mitta and Kiewa Rivers	68	204	394	295	164	505	626	1,004
Ovens River	72	221	302	332	233	526	607	1,079
Goulburn River	99	177	312	250	269	351	680	778
Campaspe River	172	158	254	250	226	313	652	721
Loddon River	125	135	205	191	189	249	519	575
Avon and Richardson Rivers	103	117	208	176	76	223	387	516
Avoca River	98	126	220	178	108	226	426	530
Eastern Wimmera	95	139	201	227	57	300	353	666
Western Wimmera	115	159	81	207	27	265	223	631
Mallee District	66	103	167	152	21	186	254	441
The whole State	104	182	266	230	183	303	553	715

N.B.—100 points = 1 inch.

10th July, 1913.

H. A. HUNT,
Commonwealth Meteorologist.

REMINDERS FOR SEPTEMBER.

LIVE STOCK.

Horses.—Still continue to feed stabled horses well; feed green-stuff if available. Continue rugging to encourage the shedding of the coat; good grooming will also be beneficial. Continue giving hay or straw to grass-fed working horses. Feed old and badly-conditioned horses liberally.

Cattle.—Cows should still be rugged, but coverings should be removed frequently, in order to enable the animal to get rid of the old coat; or, better still, a good curry-combing may be given. Continue hay or straw. Look up treatment for milk fever in *Year-Book of Agriculture*, 1905, and treat cattle accordingly. Give calves a good warm dry shed. Give the milk to young calves at blood heat.

Pigs.—Supply plenty of bedding in warm well-ventilated sties. Keep sties clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. If pigs are lousy dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect sties.

Sheep.—In early districts shearing early gives wool free from grass seed and dust, and assists fattening of sale sheep. Lambs unlikely to go for freezing thrive better when shorn. Where insufficient knowledge of grading crossbred wool exists, draft the coarse sheep from the fine into paddocks or into the shed at shearing time and shear and bale separately. Clean all "daggy" sheep before bringing them on to the shearing board. Clear carefully all straw, chaff, &c., from shearing floor and wool bins.

Poultry.—September is one of the best months for hatching. Incubators should be kept going, and broody hens set. Care must be taken to keep down vermin, as they now breed quickly; use sprays in houses and Insectibane or Pestend in nests—nothing stunts chickens quicker than vermin. The food for young chicks should be fine oatmeal, stale bread crumbs or biscuit meal, a little calcined (dry) bone, and a pinch of powdered charcoal. Slightly moisten with new milk. Make the whole friable, and feed frequently ("little and often") just as much as they will readily eat, as an excess of food only sours and disturbs their digestive organs. Do not feed animal food yet. Milk is safer, and answers same purpose. Keep chicken's feet dry—wet grass causes a chill; and once the birds are chilled, trouble may be expected.

CULTIVATION.

Farm.—Plant early potatoes, and work up fallow for the main crop. Keep fallow for summer forage crops well worked up with the disc and harrows. Make early sowings of mangolds, beet, field carrots, and turnips. Push on with the fallowing in the Northern Districts. Prepare land for tobacco seed beds by burning rubbish on the site; afterwards work up to depth of three or four inches.

Orchard.—Commence spring ploughing; plough in leguminous crops for green manure as soon as the plants are in full flower. Finish grafting early in the month. Spray peach and apricot trees with Bordeaux mixture as the blossom buds are opening, as a preventive against "leaf curl" and "shot hole" fungi; watch for peach aphis, and spray when present with tobacco solution.

Flower Garden.—Cultivate and work up the surface to a fine tilth—clear out all weeds. Water newly-planted shrubs, &c., if the weather is dry. Plant out cannas, early dahlias, chrysanthemums, gladioli, and other herbaceous plants.

Vegetable Garden.—Plant out seedlings. Sow seeds for summer use, such as tomatoes, cucumbers, marrows, pumpkins, melons, &c. Plant out tomatoes, and shelter till frosts are over. Hoe and work up the soil surface.

Vineyard.—Plantation of young vines (grafted or ungrafted) should be concluded before the commencement of September; pruning of old vines likewise, as well as tying down of rods on long-pruned vines. Prune recently-planted vines just before buds commence to swell (if not pruned when planted), cutting strongest cane back to two buds. Do not delay this work until buds have shot, as this seriously weakens the young vine. Towards middle of month, field grafting may be commenced, if weather be fine and warm. If cold and wet, postpone until October. Swab with acid iron sulphate vines which showed signs of Black Spot last season. To avoid burning, this must be completed before the buds commence to swell. Cultivation (scarifying or discing) must receive attention when soil is in suitable condition.

Cellar.—Conclude spring racking early in month, if not already done. Fill up, regularly, all unfortified wines.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 9. 10th September, 1913.

THE MILLING AND BAKING QUALITIES OF VICTORIAN WHEAT.

By A. E. V. Richardson, M.A., B.Sc., Superintendent of Agriculture; P. R. Scott, Chemist for Agriculture, and F. H. Winslow, Departmental Miller.

I.—Introduction.

In the pioneering stages of the wheat industry in Australia it was only natural to expect that the pioneers, owing primarily to the relative scarcity of labour and capital, on the one hand, and the relative cheapness of virgin land on the other, would adopt extensive methods of culture, in which large acreages were annually cropped and small average yields obtained. As the industry developed, local production soon overtook local consumption, and the necessity thus arose for the exportation of the surplus. The prices of the commodity came to be governed by the world's markets, and, through the stress of outside competition, the rise in local land values, and a falling off in soil fertility, the necessity for more intense methods of culture became obvious. The result was reflected in the vastly improved methods of wheat growing adopted during the last decade, and a series of large harvests.

But while our wheat growers have made great advances in the adoption of up-to-date machinery, improved methods of cultivation, soil fertilization, and crop rotation—it is a matter for regret that the methods of marketing and financing the crop are the same as those in vogue when the industry was in its infancy. Wheat is still sold on the f.a.q. basis, a system which gives the grower no encouragement to produce a prime product, or to trouble about such questions as the milling quality of the grain he raises.

The recent report of the Royal Commission on the marketing of wheat very forcefully pointed out the manifold objections of the existing system of marketing, and strongly advocated, coincident with the

installation of bulk handling, the adoption of four permanent grades for standards of quality, namely, (1) hard milling wheats, (2) No. 1 export, (3) No. 2 export, and (4) wheat of no grade.

It would appear with every natural product exported, save wheat, the question of quality is a paramount factor in the determination of the market price. The value of butter, lamb carcases, and fruit is determined by their quality, and, consequently, these products are regularly and systematically graded for export. With wheat, however, the man who produces a prime product does not ordinarily receive any more than the grower who is indifferent or careless in the preparation of the sample.

That this system of marketing is most unsatisfactory must be obvious to the most casual observer, and until some system of grading Australian wheat according to quality is permanently adopted, the wheat will not realize that high price in the world's markets to which its specific qualities entitle it.

The immediate result of the f.a.q. system of marketing is that the farmer's attention has been concentrated solely on those varieties of wheat which give him heavy yields per acre, irrespective of the quality of the grain. The result has been that the growing of varieties of wheat of high milling and baking quality has been neglected, partly because these varieties are generally less prolific and partly because insufficient encouragement has been given by the trade for the production of these high quality wheats. The attitude of the farmer is, of course, perfectly rational; as, while existing conditions of marketing continue, it is idle to expect him to grow any other than the most prolific varieties of wheat. His ideal variety of wheat must, therefore, be the prolific variety—one which will fill the bag. The miller, on the other hand, prefers those varieties which will mill readily and yield on milling a high percentage of flour of good colour, since the greater the yield of flour of quality in comparison with the offal, the greater will be his profits.

The ideal variety for the baker is one which yields a flour of high strength, *i.e.*, a flour which will yield a maximum of well-piled loaves of bread of good colour, texture, and quality per sack of flour.

The wheat breeder's ideal is to produce a variety which will completely satisfy the farmer, the miller, and the baker, and the problem in all countries where wheat breeding is actively carried on is to produce varieties which are prolific, and which on milling yield a high percentage of flour of good colour, high strength gluten content, and of good baking quality It is commonly supposed that prolificacy and quality in wheat are necessarily opposed—that it is not possible to combine in the one variety high yielding capacity and high milling and baking quality. This impression has probably gained ground because varieties of high milling quality at present grown in Australia are frequently poor croppers. But in the Red Fife wheat—the Hard Red of Manitoba—we have an instance of a variety which is the best yielder in several Canadian provinces, and withal a wheat of excellent milling and baking quality. The home-grown wheats of England are invariably soft, white, of low strength, and, in comparison with foreign

wheats, sell at reduced rates. Biffen, of Cambridge, has produced a cross-bred variety, which, grown in England, is not only as prolific as ordinary English wheats, but has a strength nearly equal to the best Manitoban wheat.

Can High Strength Wheats be Produced in Australia?

It was formerly thought that wheats of exceptional strength could not be produced under Australian skies—that there was something in our climate which prevented locally-grown wheats from rising beyond a certain measure of strength and gluten content. A considerable amount of work has been done on the influence of climate on the composition of wheat, and it will be necessary in subsequent articles to review this matter in considerable detail. It is only necessary to point out here that while the quality of the grain is in a large measure dependent on the climate, it is also an inherent characteristic of the

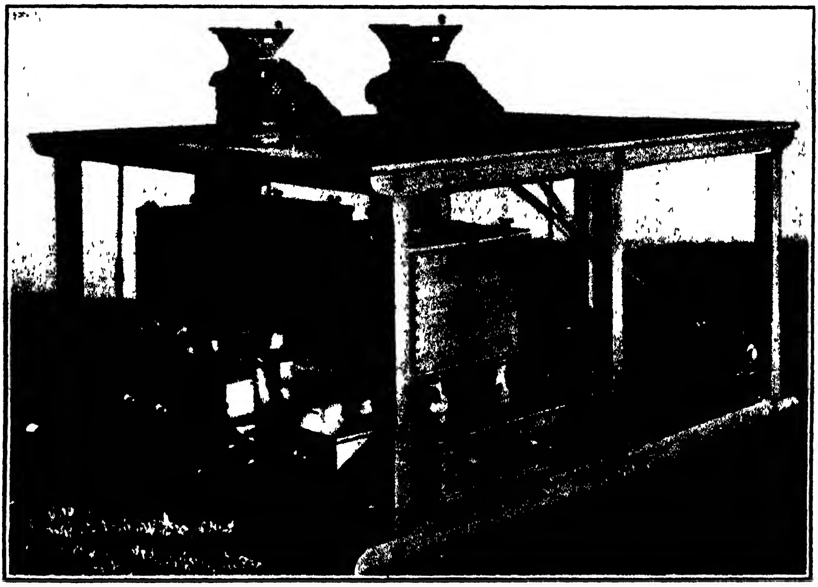


Fig. 1.—The Mill.

variety. Varieties have, indeed, been evolved under Australian conditions by the late Mr. Farrer, of New South Wales, which are equal in milling quality to any wheats in the world. Unfortunately, as already indicated, these varieties generally give indifferent yields when grown in the field. They are, therefore, not popular with farmers. A great advance will be made when Australian varieties of wheat are evolved which will combine high yielding capacity with high milling and baking quality.

In the evolution of such wheats the experimental flour-mill and baking oven will be of invaluable assistance. In the work of wheat improvement they form the natural complement of the experimental field plot. The field plots enable comparisons to be made of the relative prolificacy of different varieties under identical soil conditions. The experimental flour-mill provides exact information regarding the

milling qualities of the different varieties, whilst the experimental baking oven enables judgments to be passed on the value of the flour for bread-making purposes.

Departmental Flour-mill.

During the past year a small milling plant and an electric baking oven have been installed in the Department for the purpose of conducting milling and baking tests with Victorian wheats and flours. Similar mills have been in operation in New South Wales, Queensland, South Australia, and Western Australia for some years past. The primary purpose of these mills has been to assist in the work of wheat improvement. The systematic improvement of wheat in milling and baking quality by any of the recognised methods of breeding would be incredibly laborious without the assistance of such an experimental mill. Such improvement would necessitate the separation and culture of each strain or variation in any cross-bred until sufficient quantities of wheat accumulated to perform a milling test in an ordinary mill. With this specially constructed experimental flour-mill as small a quantity as 1 lb. of wheat can be used for a milling test, and the work of improvement thus shortened at least two to three years. It thus becomes possible to readily eliminate among a group of new varieties of equal prolificacy, those strains which are wanting in milling excellence. Apart from its use to the wheat breeder, these mills are of service to millers, the wheat grower, and the shipper.

Fig. 2.—Electric Baking Oven.

Repeated tests have demonstrated that these small experimental mills will give as accurate an indication of the milling quality of the flour from 1 lb. of wheat as can be obtained in a commercial mill from the milling of 40 bags of wheat.*

Moreover, the milling products obtained from the experimental mill from a given sample of wheat are practically identical with those obtained from a commercial mill. That they are of service to the

* *Vide* "Milling Experiments," Bulletin No. 52, South Australian Department of Agriculture.

miller is indicated by the fact that many milling firms in America and on the Continent have installed these small mills, and systematically and thoroughly test various parcels of grain before running the wheat through the ordinary mill. The wheat grower may get information as to the milling quality of his wheat and probable value of such grain to the miller. Also the mill will be of service in connexion with the adjudication of wheats entered for competition at agricultural shows. For many years past, the wheats competing for prizes at Sydney and Adelaide Royal Shows have been tested on the departmental mills, and points awarded for such definite qualities as ease of milling, percentages of milling products, colour, strength, and gluten content of the flour.

The electric baking oven enables the flour tests to be carried out still more extensively, and provides exact information regarding the quality of the bread that can be made from a given sample of flour, and the colour, volume, texture, and quality of the loaf.

During the present year some investigations relating to the milling and baking qualities of some of the more commonly grown varieties of wheat have been made, the results of which will be made available from time to time in this *Journal*. Much of the work done has been of a preliminary character, but it is proposed, immediately after the coming harvest, to make a systematic examination of the chemical and milling qualities of the wheat grown in each of the wheat districts of the State. Up to the present, the work has been confined to two centres, Longerenong in the Wimmera, and Rutherglen in the north-east. Before consideration is given to any results, and by way of prelude to future discussions, it will be necessary to review very briefly the structure of a grain of wheat, the chemical composition of the grain, what constitutes milling and baking quality in wheat and flour, and the principles involved in the milling of wheat and baking of bread.

Structure of the Grain.

A grain of wheat is composed of three distinct parts—

(*a*) Protective covering.
(*b*) Germ or embryo.
(*c*) The endosperm.

The protective covering consists of a series of more or less well defined layers, at least five in number (Fig. 3). These various coats or layers serve as a protection for the germ and endosperm. In the process of milling they become detached from the remainder of the kernel, and collectively form the bran. The most important of the various layers in the protective coat is the aleurone layer, which consists (Fig. 3) of large more or less rectangular cells, with thick cell walls containing oil and granular nitrogenous matter. It is frequently called the gluten layer, though this is a misnomer, as the gluten found in the flour is derived from the starch cells of the endosperm, and not the aleurone layer.

The Germ or Embryo is situated at the end opposite the brush, and is the portion of grain destined to form the future wheat plant. It is rich in protein, fat, and oil, and contains but little starch.

Opinions differ as to whether or not the germ should be removed from the flour; but the balance of evidence is in favour of its removal. The presence of the germ tends to discolour the flour, and the high percentage of oil and protein tend to impair the keeping quality, and develop rancidity, and it is therefore generally removed in the process of milling.

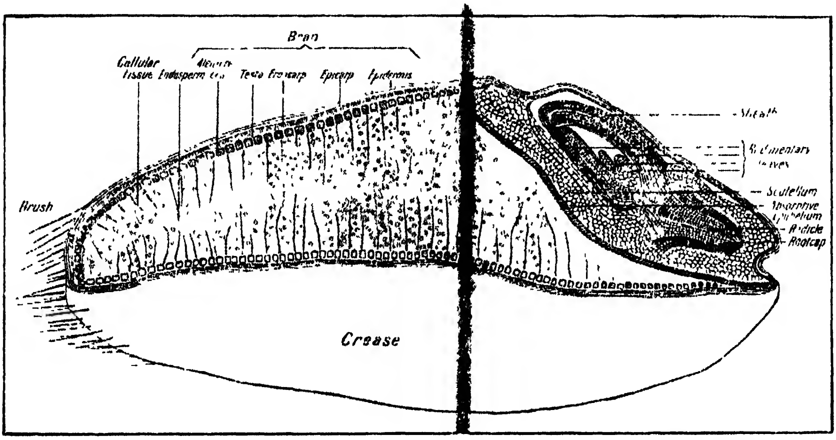


Photo.] [C. C. Brittlebank.

Fig. 3.—Longitudinal Section of a Grain of Wheat, showing the internal structure.

The Endosperm.—This occupies from 75 to 80 per cent. of the kernel. It acts as a storehouse of food for the young plant during the time it is seeking to establish itself in the soil. It is composed principally of starch cells, large elongated cells, with their long diameters arranged radially to the surface of the wheat berry. The starch cells consist of an outer covering of cellulose, containing numerous starch grains and a considerable amount of gluten. It is the endosperm which forms the flour in the process of milling.

Chemical Composition of Wheat.

A grain of wheat consists of a number of ingredients of varied chemical composition. For convenience, these ingredients are generally arranged in six groups, as follow:—

- Moisture,
- Protein,
- Crude fibre,
- Ether extract,
- Nitrogen free extract, and
- Ash.

A representative sample of Victorian wheat (f.a.q. sample, 1911-12) gives the following analysis:—

	Per cent.
Moisture ...	10.43
Protein ...	11.26
Crude fibre ...	2.32
Nitrogen free extract ...	71.97
Ether extract ...	2.79
Ash ...	1.23

When wheat is heated in an oven at a temperature of boiling water, it loses weight. This loss of weight represents the moisture. If the dried portion be further heated to dull redness in a current of air, a small whitish residue remains—the ash—whilst the portion incinerated is the organic matter. This organic matter, which constitutes the greater portion of the grain, may be divided into two groups—

(*a*) Nitrogenous, represented in the above analysis as protein.

(*b*) Non-nitrogenous, including the fat or ether extract, carbohydrates or nitrogen free extract, and crude fibre.

These proximate constituents may now be considered *seriatim*.

Water.—The amount of water present in wheat varies considerably, according to the district in which it is produced. Generally speaking, the lower the percentage of moisture the better the quality of the wheat. A high percentage of moisture in a wheat is objectionable, because it not only leads to loss in weight of the mill products, but also tends to make the flour unstable and liable to fermentation.

Protein.—The most important constituent in the grain is the protein. It is the ingredient responsible for the repair of muscular tissue. The proteins are complex bodies, and vary in their chemical properties. Typical proteins are white of egg, casein, and gluten of wheat. The proteins contain on an average 16 per cent. of nitrogen. The quantity of crude protein present in a wheat is therefore obtained by multiplying the percentage of nitrogen by 6.25. Besides the proteins, there is always a small amount of non-protein matter in the grain. The amount, however, is so small that it may be considered a negligible quantity as far as comparative examinations are concerned. The non-proteins are called amides or amino-compounds, and they are generally found in greatest quantity in young, immature plants. The most important of the proteins in wheat is gluten, the name given to the sticky-elastic mass obtained when dough is kneaded in a stream of water until the whole of the starch is removed. The gluten is really composed of two proteins—gliadin, soluble in a 70 per cent. alcoholic solution, and glutenin, which is insoluble. Besides these proteins, three others have been isolated, leucosin and proteose, soluble in water, and edestin, soluble in a 10 per cent. salt solution. According to Osborne and Voorhees,* the relative amount of the various proteins in the wheat kernel are as follow:—

	Per cent.
Leucosin	0.3-0.4
Proteose	0.3
Edestin	0.6-0.7
Glutenin, Gliadin	9.50

Ether Extract.—This extract contains not only the fat, but also all the other matter soluble in sulphuric ether. In wheat, the extract is practically pure fat. It is of a light yellow colour, darkening on exposure to air. This fat is liable to become rancid on keeping, hence the necessity for the removal of the germ which is rich in fat, from the flour. The fat consists of several fatty acids, principally oleic, in combination with glycerine, as glycerides. Like the carbohydrates it is composed of carbon, hydrogen, and oxygen, but it contains a much

* Osborne and Voorhees—*American Chemical Journal*, Vol. vi

higher percentage of carbon than the carbohydrates. When burned, it gives two and a half times as much heat.

Carbohydrates.—These include crude fibre and nitrogen free extract. They contain, among other substances, the following:—starch, sugar, dextrin, cellulose, pentosans, &c.

The crude fibre is that portion of the wheat which resists the solvent action of a weak boiling solution of—first, sulphuric acid, and afterwards, weak caustic soda. The residue remaining undissolved consists of a mixture of cellulose, pentosans, and lignin.

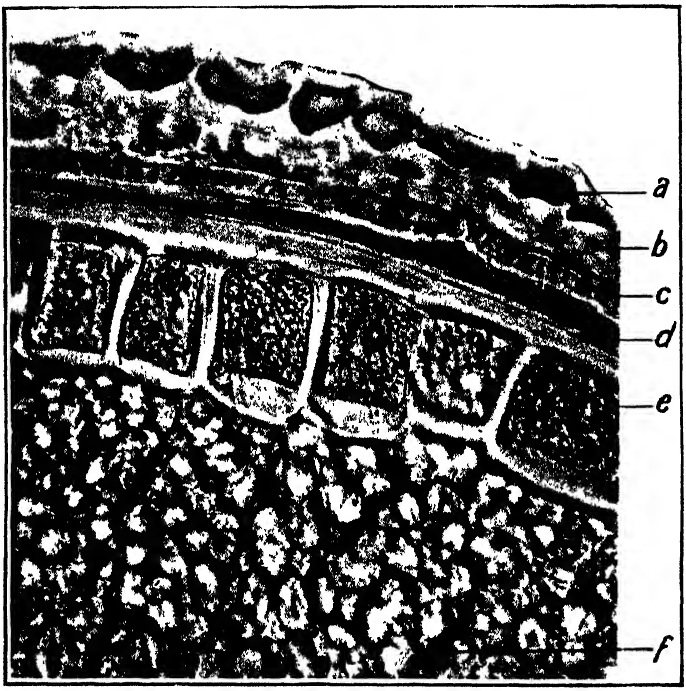


Fig. 4.—Transverse Section of Federation Wheat. x 400, Showing Structure of Protective Coats and Endosperm.

(*a*) Epidermis, (*b*) Epicarp (*c*) Endocarp, (*d*) Testa, (*e*) Aleuron-layer, (*f*) Endosperm

Cellulose is closely related to starch, and can be found almost pure in cotton-wool after the fat has been extracted from it. The lignin is of a more woody nature, and forms the greater part of the outer cell walls of the berry. The cellulose is that portion which encloses the starch and aleurone cells, and is the material which gives form and structure to the plant tissue. Pentosans aid the cellulose in giving substance to the plant tissues. They differ from cellulose in being soluble in dilute acids. They are so called because they yield a sugar containing only five atoms of carbon to the molecule. They are rendered soluble by the digestive fluid, and can be utilized as food.

The nitrogen free extract.—This includes all the other constituents not included in the other groups. Owing to the number, and all possessing more or less the same chemical characteristics, they are generally determined by difference. This group includes all the

carbohydrates other than those mentioned under the crude fibre group. The term carbohydrates is applied to a class of bodies composed of carbon, hydrogen, and oxygen, which contain twice as many hydrogen as oxygen atoms in each molecule, the hydrogen and oxygen being present in the same proportion as in water—two of hydrogen to one of oxygen. Starch is the most important carbohydrate found in flour, and constituting about 65 per cent. of its bulk. It is, therefore, of importance, as it is the principal food-stuff in bread. In sound wheat, the starch granules are whole; should the wheat be soaked with water and become heated, or in the event of the wheat being sprouted, these starch granules become pitted, and portion of the starch is converted into sugar and dextrin.

Besides starch, there is always a small amount of sugar and dextrin found in wheat. In sound wheat, the sugar present should be as cane sugar. If present as maltose, this indicates that a partial change has taken place through the hydrolysis of portion of the starch by enzymes into maltose. The presence of dextrin is due to the same cause.

Ash.—The ash is of considerable importance from an agricultural point of view. Whilst the organic portion of the plant may be wholly obtained from the air and from water, the inorganic or mineral portion is obtained exclusively from the soil. In view of the prominence given to the ash constituents in recent discussions on strength, we append the average analyses of the ash constituents of ten typical Victorian wheats:—

Average Ash Analyses of Ten Typical Victorian Wheats.

	Per cent.
Ferric oxide (Fe_2O_3)	0.50
Alumina (Al_2O_3)	0.58
Brown oxide of manganese (Mn_3O_4)	1.62
Lime (CaO)	3.72
Magnesia (MgO)	14.61
Potash (K_2O)	29.93
Soda (Na_2O)	3.24
Chlorine (Cl)	0.90
Sulphuric anhydride (SO_3)	3.02
Phosphoric anhydride (P_2O_5)	40.87
Silica (SiO_2)	1.51
Total	100.50
Less Oxygen = Chlorine	0.50

Commercial Testing of Flour.

In judging the commercial value of a flour, the miller and baker are guided largely by the colour, strength, gluten content, and flavour of the flour.

Colour.—The colour of the flour is very important to the miller, and his constant aim is to produce a flour which will yield, on baking, a loaf of snow-white colour. The consuming public have got into the habit, whether rightly or wrongly we need not consider here, of judging the quality of bread by its colour. Dark-coloured bread, such as would be made, *e.g.*, from certain durum wheats, would be looked upon with grave suspicion by the consuming public, accustomed for

long years to white bread. It does not follow that the snow-white bread is more nutritious than the dark-coloured bread made from the flour of certain varieties of wheat. Indeed, experiments have demonstrated that certain of these varieties produce bread of greater dietetic value than bread from the white wheats.

The point is that the public demand snow-white bread, and the miller seeks to meet that demand. Hence the reason for the "bleaching" of many of the darker flours with nitrogen peroxide, so commonly practised in America during recent years.* Such bleaching, however, is quite unnecessary with the greater number of Australian varieties, for these have obtained world-wide renown on account of the excellent colour of the flour. One of the reasons why Australian wheat is so prized on the English market is that it yields, on milling, a flour of excellent colour, and is therefore of the greatest value for blending with the darker, but more glutenous and stronger, foreign wheats.

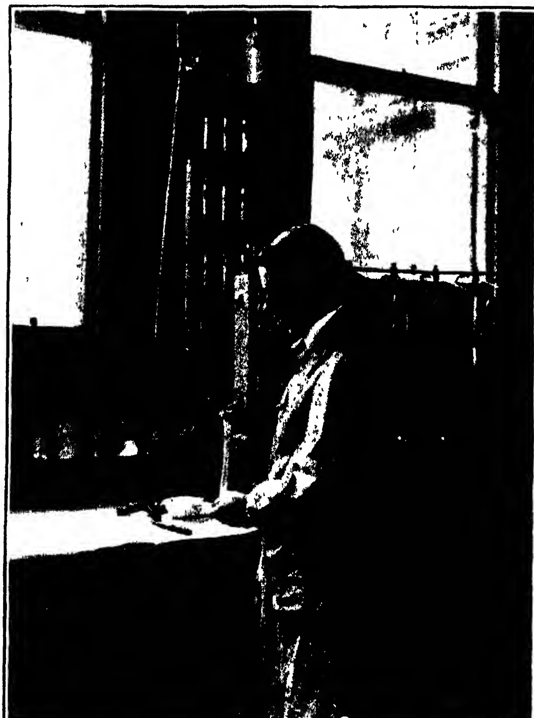


Fig. 5.—Estimating the Water Absorption Capacity of the Flour.

The test generally employed for judging the colour of the flour is the well-known Pekar's test. A simple method of carrying out this test is to take a small glass slide 3 inches x 1 inch, ground on one side, and, with a spatula, firmly compressing a small quantity of flour on the rough side of the glass, and immersing the whole for a few seconds in water. On allowing the mass to dry, the surface of the flour forms a firm continuous skin, and changes to a colour characteristic of the variety. The majority of Victorian-grown wheats have a creamy colour. Wheat from Gippsland gives a dull, dead white colour. Durum wheats yield a flour of deep yellow tint, whilst a few varieties of this species—Medeah, Huguenot, &c., show patches of dull brown. Flour of a grey or light yellow colour usually gives a good white loaf.

Strength.—A strong flour from a baker's point of view is one that is capable of absorbing a large quantity of water and of yielding a large quantity of bread of good shape and texture per sack of flour.

* *Vide* "Wheat and its Cultivation," p. 95, *Journal of Agriculture*, February, 1912.

Jago* defines strength as the capacity of the flour for producing a bold large volumed, well-risen loaf. The Home-grown Wheat Committee† defines a strong wheat as one which yields flour capable of making large well piled loaves. It is evident, therefore, that a baking test is necessary in order to obtain the requisite information.

The question of what constitutes the strength of flour from a chemical stand-point has given rise to a number of investigations of more or less practical significance. A brief *résumé* of some of them will now be outlined. Ever since the researches of Messrs. Voorhees and Osborne into the composition of the proteins of wheat up to recent times the opinion was generally held that the gluten content was a prominent factor in determining the strength of the flour This may be partly accounted for by the fact that a high gluten content was generally associated with a strong flour, and that gluten possessed a certain amount of tenacity which enabled it to hold and enclose the carbon dioxide gas generated during the baking process through the agency of the yeast. Exception was taken to this opinion, it being found that it does not always follow that high gluten wheats give such large well-piled loaves as some other wheats containing a lower percentage of gluten. The failure on this point led to a series of investigations into the difference of the quality of the gluten from a physical and chemical point of view.

The water-absorbing power of the gluten was then examined by comparing the difference in weight between the wet and dry gluten. The expansion of the gluten was also determined by means of an instrument designed for the purpose—the aleurometer—the gluten being heated up to the temperature of the baking oven, and the expansion measured by a scale. Both these tests have been accredited with affording some indication of the strength with indifferent results. Gluten, as has been stated previously, is mainly made up of two separate proteins -glaidin and glutenin. That there might be some quality due to the ratio of the one to the other of these two proteins has occasioned a good deal of work of an investigational character. Guthrie (Australia), Fleurent (France), and Snyder and Guess (America) have been prominent workers on this question.

The results of these investigations were of a variable nature, but they demonstrated conclusively that neither the absolute percentage of glaidin nor the ratio of the glaidin to the glutenin, or to the total protein, were satisfactory indicators of the strength of a flour.

Professor T. B. Wood, of Cambridge, says that strength is a composite of two factors; one which is responsible for the size or volume of the loaf, whilst the other is responsible for the shape. As the result of a series of laboratory investigations he is of the opinion " that the size of the loaf depends on the presence in flour of a ferment which is able to change the starch of the flour into sugar when provided with moisture and warmth as it is in the dough during the proving stage."

The sugar so produced provides food for the yeast, thus producing a stronger growth and evolution of carbon dioxide gas. On the other hand, the shape and texture of the loaf depends on the quality of the

* Jago —*Technology of Breadmaking*.
† Home Grown Wheat Committee of the National Association of British and Irish Millers

gluten. This in turn depends on the soluble salts contained in the flour. Wood concludes from a comparison of the soluble salts in high and low strength wheats that high strength wheats contain (*a*) a higher percentage of soluble phosphates, (*b*) a higher ratio of magnesia to lime, (*c*) a lower percentage of chlorides and sulphates, than low strength wheats.

It will be seen from the foregoing brief *résumé* that the problem as to what factors constitute strength in flour is very intricate, and at the present time there is certainly no unanimity of opinion as to the cause of strength, and as to how the strength may best be estimated. For many years past, however, it has been the custom in agricultural laboratories to use the water absorption capacity of the flour as a

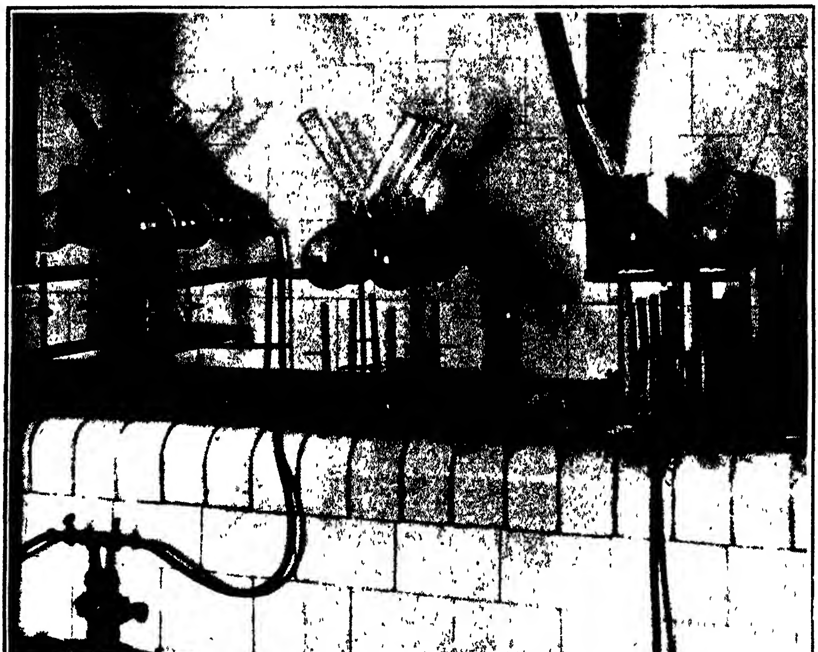


Fig. 6.—Kjeldahl Digestion Apparatus for Nitrogen Determination.

measure of the strength. When such determinations are supplemented with baking tests, accurate and reliable information can be gained as to the strength of different varieties of flour.

The water absorption capacity is determined by running from an ordinary burette sufficient water to make with 40 grams of flour a dough of a consistency fit for baking. This consistency is, of course, a matter of judgment, but, when baking tests are correlated with determination of the water-absorbing capacity, the operator can soon accurately determine the consistency most suitable for baking. The measure of strength, or water-absorption capacity, is usually indicated in quarts of water absorbed per sack of flour. Thus a flour with a strength of 48 would require 48 quarts of water to be added to a sack of flour (200 lbs.) to make a dough fit for baking. The water absorption test

is one which is very simple, and can very readily be performed by any miller or baker.

Wheaten flour differs from all other cereals in that, after it has been made into a dough with a little water, it is possible to wash away the starchy portion, and leave a sticky adhesive residue, consisting mainly of proteins called gluten. Gluten is generally considered as one of the most important constituents of flour. The physical properties of a flour may be said to depend on the quantity and quality of this material, since it is owing to the gluten that the baker is enabled to make a dough fit for baking. The carbonic acid gas produced by fermentation in the dough becomes entangled in the gluten, and gradually distends it during the rising of the dough and the baking of the bread. For a flour to be of good baking quality it is obvious that there must be a sufficient *quantity* of gluten present in the flour to retain the gas produced during fermentation, and the *quality* of the gluten must be such as to confer elasticity on the dough. Whilst the gluten must be highly elastic, and readily yield to distention without disruption, it must also be sufficiently rigid to maintain a good shape during the process of baking.

Gluten varies greatly in quality and colour. Some glutens are hard and brittle, others tough and elastic, others too elastic and with little or no gas-holding power. The colour varies from grey to brown.

(*To be continued.*)

CUT WORMS.

The Agrotis and other allied caterpillars, only too well known as cut-worms, have proved by far the worst scourge which Victorian vineyard reconstitution has had to contend against. Where active steps have not been taken to combat them, complete failure of an otherwise faultless plantation has several times occurred. In the case of planters lacking previous experience of the pest, irreparable damage has sometimes been done before the cause of the trouble was even suspected.

Growers are now on their guard, and by the methods detailed in the *Journal* for July, 1911, more especially by the use of arsenical baits, have been able to protect themselves completely, even in so bad a season as the last one, when cut-worms were unusually abundant. This has been at the cost of much vigilance and the repeated spreading of baits, necessitating the expenditure of much time and money.

In *Le Progres Agricole* of 20th July last, a novel plan of campaign against the pest is described by a Southern French vineyard proprietor, Baron Duplessis de Pouzilhac. Being strongly recommended by Professor Degrully, of Montpellier, it can confidently be brought under the notice of Victorian vine-growers.

The new method comprises two distinct phases—1st, the decoying of the caterpillars by means of vegetable baits; 2nd, their ultimate destruction with a corrosive liquid.

The bait recommended is a small patch of peas, eight seeds are enough for a patch, which should be sown near the vine, and early enough to be up before the latter starts to grow. Cut-worms, it seems, eat peas greedily; so long as these last, the vine is safe. The growing of peas, to decoy the pest away from the vine has been previously recommended in France. It is the second phase, the destruction of the caterpillars, which is new. The patch of peas serves to gather the caterpillars into a limited area, where their presence can be ascertained, and where they can be easily destroyed.

Various liquids were tried for the latter purpose, many of which failed to wet the skin of the insect. A 3 per cent. solution of commercial cresyline or creoline* was finally adopted. This proved entirely satisfactory, being very deadly to the insects, which are readily wetted by it. About a pint of solution to a patch of peas is enough to wet the soil sufficiently and to destroy all the caterpillars, which are to be found about an inch or so below the surface. It can be most conveniently applied with a spray pump with a worn nozzle, such as will produce a shower rather than a true spray.

Baron Duplessis graphically describes the effect on the pest, which is immediately evident. In less than two minutes the caterpillars come out of the wetted soil, twisting and wriggling in great agony, and dying almost immediately. Some die half buried, after frantic struggles, with only their heads out of the ground.

The peas are also killed, but there is no further use for them since the cut-worms are completely destroyed.

Lest the creoline solution might damage the young vine, the peas should be planted a couple of feet away from it. Baron Duplessis' experience, which was entirely satisfactory, was amongst full-grown vines, which, in France, are often attacked by the pest.

The cost of treatment is put down at 2s. 8d. per acre for peas—seed and labour—and 8s. per acre for destroying the grubs—solution and labour—the latter expenditure being only necessary if cut-worms appear. This is based on 1,760 vines per acre. With our wider planting, the cost would be less for seed and creoline, at least.

THE SOY BEAN—

A few years ago this bean, and the cake made from it in crushing for oil, obtained a sudden popularity among cattle-feeders in Great Britain. It was cheap, and appeared to be good. Contrary to expectation this popularity has not been maintained, and, according to *Fertilisers,* indications are present that the farmer is now somewhat averse to using it. Shipments fell from 492,000 tons in 1910 to 326,000 in 1911, and 288,000 tons in 1912. The Continent took a large proportion of recent shipments, and leading Hull crushers state that the British farmer has not taken to the soy cake as it was expected he would do.

* These French commercial disinfectants are very similar to phenyle, cresol, &c., which would probably answer just as well.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 507.)

PART VI.—IRRIGATION, CULTIVATION, AND DRAINAGE.

By S. A Cock, Orchard Supervisor, Bendigo and Northern District.

Citrus fruits cannot be successfully raised without proper and intelligent irrigation. No fixed number of waterings, or definite quantities to be applied can be laid down. Summer rains will vary the quantity and number. The practice of pouring water into the soil irrespective of the requirements of the plant is a dangerous one, especially with citrus trees. Waterlogged areas are most injurious under any system of irrigation, and irrigation should be so practised that a minimum amount of water is lost, and the actual requirements of the plant estimated. Try and place the water where it is required. Careful grading and proper levelling is necessary. Perfection cannot be attained; but it can be aimed at. Soils, situations, and climatic influences have all to be considered, and intelligent deduction made. Rainfall and evaporation should also be studied.

Generally speaking, the suitable citrus areas are situated in the northern portion of the State, where the rainy months extend from April to September, during which time two-thirds to three-quarters of the rain probably falls, the remainder falling as showers or heavy thunderstorms in the spring and summer. Periods of two to three months often occur when no appreciable rain falls. The summer climatic conditions are, therefore, dry and sunny, and evaporation great, hence, irrigation becomes a necessity to produce summer crops of any description:—

Rainfall Table for Citrus Area.

District	Number of Years for Average.	Number of Inches per Year.	Number of Rainy Days per Year.	Height above Sea-level
				feet.
Mildura .	20	10·94	54	153
Swan Hill .	27	12·39	56	227
Kerang	34	13·86	51	255
Echuca	32	16·90	76	315
Shepparton ..	13	19·58	83	372
Wangaratta .	29	24·81	77	493
Rochester ..	23	16·61	58	378
Bendigo.. ..	49	21·50	101	758
Horsham ..	37	17·62	100	434

The capacity of the soil for absorbing and retaining water as well as drainage has to be understood. Coarse-grained, open, sandy soils take water freely, and evaporate it quickly. Fine-grained, close-textured, clay soils absorb water slowly, and evaporate it slowly. Retentive clays underlying sandy soils become waterlogged under irrigation, unless artificially drained. Coarse gravels immediately underlying sandy soils drain too quickly and dry out. Sandy soils

overlying porous subsoil take water, as at Plate 34, Fig. III., by lateral spread, less readily than by downward percolation, and require fast watering. Fairly retentive subsoils underlying sandy soils take water as indicated (Plate 34, Fig. IV.) more readily by lateral spread than by downward percolation, and require slow watering. Furrows for watering should be ploughed as deep as possible. Flooded

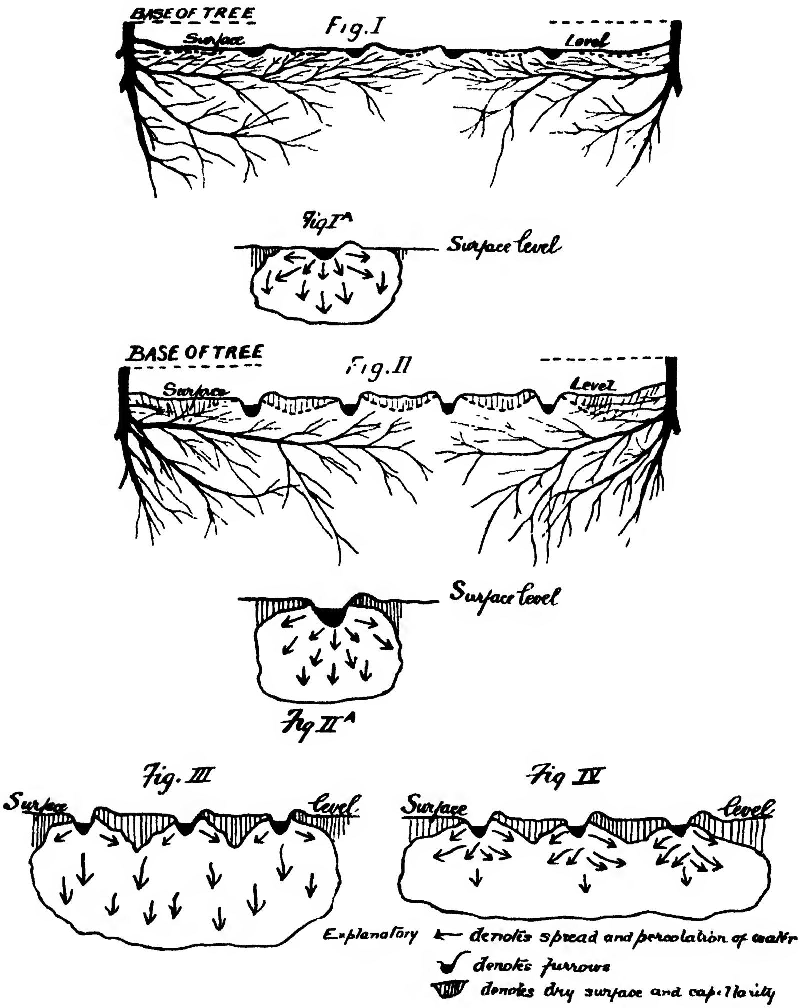


Plate 34.—Irrigation. Scale · 8 feet to 1 inch.

surfaces prevent the escape of air from the soil, and water cannot enter the soil properly until the air escapes. Watering by wide shallow furrows spreads the water on the surface, and wets the surface soil by lateral spread, as indicated in Plate 34, Fig. 1A; the wetted surface rapidly hardens after irrigation, and requires immediate cultivation to prevent evaporation. It also has the tendency to induce shallow rooting, as shown (Plate 34, Fig. I.), and exposes to injury

from cultivation implements the roots thus induced to the surface in search of moisture. Water applied in this manner has not the same downward percolation, and is not so beneficial as when applied in deep furrows. Furrows should be thrown out at least 8 inches deep, the water is then kept in the bottom of the furrow, and the spread is lateral and downward under the surface, as shown at Plate 34, Fig. IIA. After irrigation, cultivation is, of course, necessary, but very often, especially as regards young trees, all that is required to hold the moisture is to plough the out-turned sod back into the wet furrow, thus retaining the moisture by a soil mulch. No other cultivation is necessary, except light hoeing the wetted surfaces surrounding the tree to break capillary ducts. This deep furrow irrigation ensures deep rooting, as shown at Plate 34, Fig. II., and no danger or risk of injury to roots by cultivation.

Where applied to trees over three years old by running in three or four furrows, the whole surface should be cultivated after irrigation. The deep furrow system allows of the free escape of air from the soil. The estimated air space in cultivated soils is from 25 per cent. to 50 per cent. of their volume, and this space, if filled with water, is the maximum capacity, or saturation point. This state is not required; plants thrive best when half the pore space is filled with air, or the capillary water present amounts to not more than 50 per cent. of its water-holding capacity. Roots require the presence of oxygen for the performance of their vegetative functions, and, in a large measure, the productiveness of highly-cultivated soils is due to the ready access of air to the roots. Citrus trees have shallow feeding, as well as deep feeding, roots, and the natural shape of the tree indicates that the branches spread over the shallow feeding roots to prevent evaporation. In its primal state it conformed to environment, probably droughty conditions. In most of our soils the natural rainfall will carry on the tree for a time; the tree will survive, but not succeed, and, in order to ensure success, water requirements must be considered.

An orange grove twelve years old, and planted 20 feet apart, is calculated to evaporate 9-acre inches of water in one year. (United States Department of Agriculture, 1889.) On the granitic, sandy soils of Harcourt, apples and pears are produced successfully on an annual average irrigation of about 6-acre inches, supplied at three or four periods during the summer. Without irrigation, successful crops could not be produced. On the silurian soils of the Bendigo district irrigation for deciduous trees is not generally practised, only in exceptionally dry seasons. Oranges and lemons, however, require from 3 to 6-acre inches of irrigation water per year, applied at three or four times during the summer. At Echuca and Rochester, deciduous fruits can be successfully raised on about 4 to 6-acre inches of irrigation water per year, applied in three periods, October, December, and early February. Twelve to twenty-year-old citrus trees require from 6 to 12-acre inches of irrigation water per year—about 6 inches on the Murray sedimentary soils, and up to 12 inches on the sandy, pine-ridge country. This total quantity is applied at three or four periods, October, December, and February, and a later watering if the autumn be dry, giving from 2 to 3-acre inches each watering. The late autumn irrigation should only be given when the trees absolutely

require it, as the tendency is to reduce the temperature of the soil too much to allow of vegetative activity. In exceptionally dry seasons allowance has to be made, and rainfall deficiency averaged, also allowance made for increased evaporation.

At Swan Hill, Nyah, and Mildura, evaporation is greater, and rainfall less, consequently more water is required. Autumn ploughing and early September ploughing will conserve the winter rains, and Mr. C. McDonald, "Riversdale," Koondrook, a most careful irrigator, states, "I fully believe, by late autumn and early spring ploughing, and frequent summer cultivation, I can so conserve the winter rains that I will be able to successfully produce citrus fruits on half the water I am at present using."

Head ditches and main distributory channels should not be placed too far apart. In leading water down a furrow, it stands to reason that the ground nearest the supply channel receives the most water; therefore, it is advantageous to try and equalize the distribution. No furrow should be over five chains in length, and, if it is possible, they should be less. The practice of making deep delver drains can also be improved on. In grading deep soils, enough soil can be spared and gathered to form a good strong ditch, or other channels on the surface.

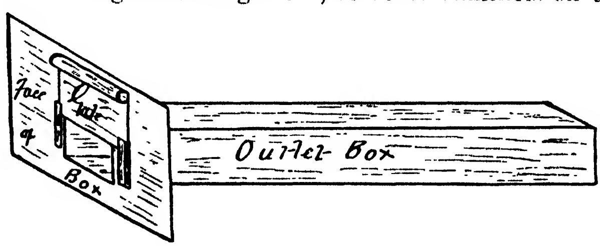


Plate 35.—Outlet Box.

Care must be exercised in making the banks to see that they are strong enough to carry the water in the channel. A lot of seepage takes place from delver drains. A channel prepared as suggested prevents a deal of seepage, as the soil is not broken. Outlet boxes are also easily placed in such constructed channel banks, and take the water from the bottom of the ditch. Breaking the channel banks for every irrigating is not economical; outlet boxes, with regulating gates should be provided for every row or two rows of trees. A convenient size for one row of trees of two furrows will be found 2 inches square; boxes as described can be made of galvanized iron or wood, and should be 3 feet long in the box, with a broad face and gate. See Plate 35. The gate portion is placed in the channel, and can be locked down to any quantity of water desired. The broad face prevents seepage in the bank where the box is placed. The cost of these boxes is not very great, and the convenience in use compensates for the outlay.

The system of watering varies. The most economical system for one and two-year-old trees is shown at Plate 36, Fig. I. Furrows are led down each side of the tree 2½ feet away, and spurs led into the tree as at A and B, in Plate 36, Fig. II. Furrows are led down, and also ploughed across, and joined up as at C and D. Cross furrows are indicated by dotted lines, and, where joined with distributing furrows, by thick lines. One-year-old trees require frequent waterings; about

once a month will be found sufficient. At two and three years, the furrows are placed a little further away from the tree, 3 to 3½ feet, and joined up with the cross furrows, as at C and D, Plate 36, Fig. III. At two and three years, four or five waterings will probably be found sufficient. At four, five, and six years, the furrows are placed a little further away, and an additional furrow led down the centre, and across, and joined up as at C and D, Plate 36, Fig. IV. At this age trees may require water every five or six weeks. From seven years and upwards, four furrows should be led down between each row and across, the nearest furrow to the tree being 4½ to 5 feet away from the butt, and equidistant between each furrow 4 feet, and joined up as at C and D, Plate 36, Fig. V. Allowing the lateral underspread of water

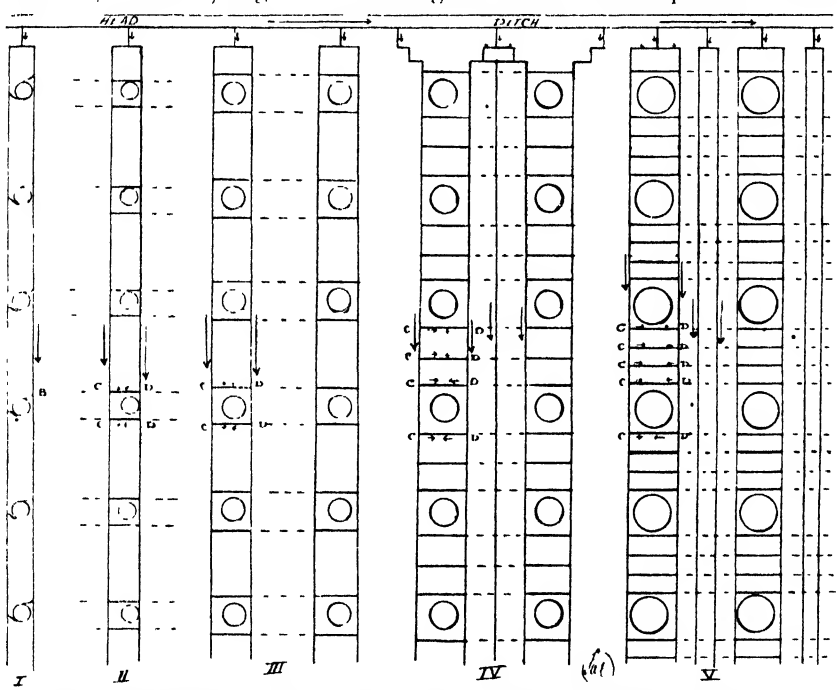
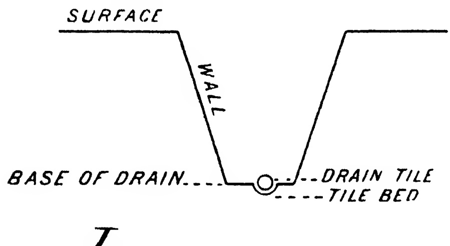


Plate 36.—Method of Watering. Flow of Water indicated by Arrow. Scale: 40 feet to 1 inch.

in average citrus soil at 2 feet, there should be perfect wetting of the under-soil and equal watering, the distance of the furrows from the trees, 4½ to 5 feet, being compensated for by mulching, and less evaporation, owing to pendant foliage. Trees from seven years upwards require watering three or four times in the year, or about every six or eight weeks. Plate 34, Fig. I., shows a cross-section of four furrows, and equal shallow furrow watering. Plate 34, Fig. II., shows equal deep furrow watering and advantage gained by deep underspread of water, and consequent deeper rooting.

Cultivation is directly beneficial in retaining the water in the soil, and holding it at proper heights, so that the plant will receive the maximum benefit from the minimum application of water. Sandy soils dry out quickly by reason of the fact that downward percolation and

capillary ascent is quickest. Wetted surfaces assist in evaporation. Dry mulches prevent evaporation, consequently cultivation is practised to prevent this and retain the moisture in the soil. By cultivation, capillary tubes are broken, hence after irrigation it is necessary to cultivate. Rain causes the soil particles to run together, and consequently increases their capillarity, hence these must be broken up. Cultivation reduces the quantity of water to be applied. Soil aeration is necessary to nitrification. In sour soils nitrification is interfered with, hence cultivation and good drainage are essential. Cultivation is not required in the winter, so a calendar of work may be laid down. Plough in the autumn after the first rains, leaving a furrow in the centre of the land, ploughing to the trees In early September plough from the trees, filling in the furrow in the centre of the land. Harrow and cross-harrow. Cultivate, after every irrigation or rain, from October to March. Plough at varying depths to prevent hardpan, caused by plowsole. Cultivate with the disc or spring-tooth harrow in the summer. Under-drainage is a great advantage; residual water is thereby removed, and stagnation prevented. The apple orchards of Harcourt are nearly all tile drained. In 1900 the citrus trees of Mildura were in a serious condition; over-irrigation and channel seepage had brought about waterlogged conditions with their attendant evil consequences.



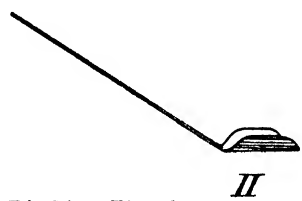


Plate 37.—Fig. 1. Drain Fig. 2. Ditching Plough.

At the suggestion of the writer, tile drains were introduced, and the drains carried into wells sunk into the drift. This system is now being more generally adopted. At Cohuna it will have to be faced in regard to alkali soils, and also in many of our new settlements for channel seepage. If no drift is to be found to drain into, then the water in the wells can be thrown out by windmills. The water should be kept moving. Tile drains are best placed 2½ to 3 feet deep in the ground. Drains should be laid at least in every second land, and 3-inch tile drains used, joining into a main 4-inch drain, which leads into a well or any natural depression. Drainage is necessary on irrigated areas; it is an essential in citrus culture, and is of direct benefit wherever practised. The consensus of opinion of growers who have tile-drained orchards is that under-drainage minimizes the quantity of water to be applied, and increases the productiveness of the orchard. Three-inch drain tiles cost £4 5s. per 1,000 landed at Harcourt. The cost of cutting drains 2½ feet deep, laying the tiles, and filling in is about 5s. per chain, or a total cost of about 10s. 6d. per chain. In the Harcourt district the drains are cut with a ditching plough, and the bed cut out with a ditching shovel, as shown in Plate 37, Fig. II. This cuts out a hollow big enough to receive the tile, and prevents side roll. Plate 37, Fig. I., shows cross-section of a drain, with tile fitting in tile-bed. Only round

tiles should be used, and they should be joined up as close as possible and properly bedded. In returning the soil, care should be taken not to displace the tiles. Return the clay first, tightly pack, and then the soil. In mapping out the orchard for the drains, the fall should be reckoned. The main drain is carried up the lowest part, and the lateral drains are brought to it in parallels down the inclines. Where the surface is not undulating, the drains are usually cut in parallel lines down the declination of the ground, not that all the drains of the same orchard shall be parallel, but only those in the same plane, whatever number of planes may exist. In an orchard of one plane there can be no difficulty in setting off the small drains, as they should be parallel to one another, and all terminate in the same main drain, whether the orchard is nearly level or has a descent. Drains should be carried

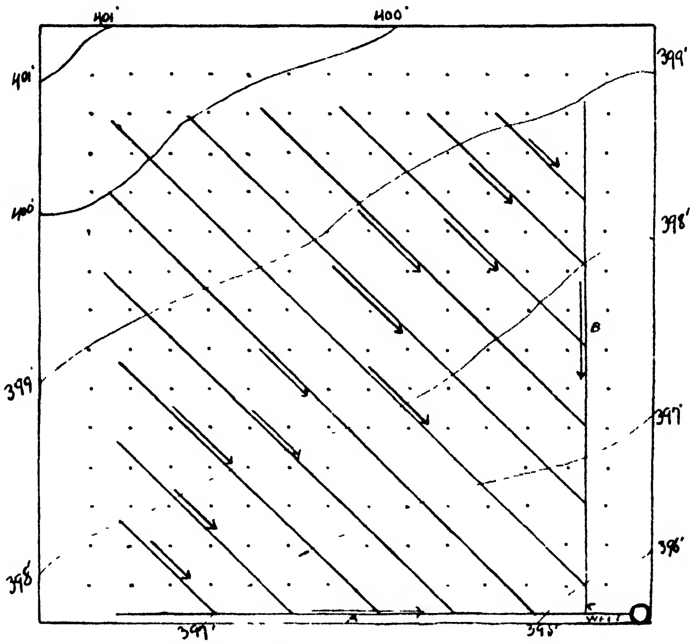


Plate 38.—Drainage of an Orchard. 401-396 Contour Lines.
Scale: 110 feet to 1 inch.

through each plane of the orchard irrespective of the wet or dry appearances of the soil, because the complete removal of all stagnant water is the object aimed at by draining. Portions of the land which may appear dry at one time may be in a wet state at another, and may seem always dry on the surface when in fact the subsoil may be in a state of injurious wetness. Drains cut across the decline have not the same effect upon tenacious and impervious strata as drains cut up and down the slopes.

Plate 38 shows the drainage of an orchard drained in every second land. A is the main drain, B a secondary main drain junctioning with A at C and draining into a well or some depression, and typical of our irrigation areas.

(*To be continued.*)

BEE-KEEPING IN VICTORIA.

(*Continued from page 493.*)

By F. R. Beuhne, Bee Expert.

XIV.—DISEASES OF BEES—*continued.*

Disappearing Trouble.

Of the cause of the periodical mortality known by the name of Disappearing Trouble or Spring Dwindling nothing definite is as yet known. It appears to be a result of certain climatic conditions in the autumn preceding a winter or early spring honey-flow from certain eucalypts, and is looked upon rather as a condition of the bees than a disease. A characteristic of this trouble is that there are no symptoms. Colonies become gradually, and sometimes rapidly, weaker day by day without more than the normal number of dead bees being visible in or near the hives, while under microscopical examination neither dead nor live bees from the dwindling colonies differ in any way from bees of normal colonies in districts unaffected. If the dwindling takes place during midwinter the queen and the last hundred or so of bees perish from cold; when it occurs in spring, the bees and queen swarm out and join some other colony when a point of numbers is reached from which the colony could no longer recover. The queens of colonies which dwindled in this way, when introduced to normal colonies in an unaffected locality, do not reproduce dwindling in succeeding seasons, and the combs from which the bees disappeared in no way affected other bees which were put on them.

During the spring of 1909, and again in 1912, heavy losses of bees were experienced in the country near the Grampians, but not in the scrub country on and inside the ranges. In both 1909 and 1912 there was a dearth of pollen in the preceding autumn, followed by a honey-flow from ironbark eucalypts, *E. leucoxylon* and *E. sideroxylon*. The former is known by different names in different localities, such as white ironbark, bluegum, whitegum, and spotted box. The latter is everywhere called red ironbark. Both are winter bloomers, and secrete nectar very freely, but produce no pollen for bees.

It has been suggested that the abnormal activity of the bees during a period when they should be semi-dormant, which is caused by the flowering of ironbarks, causes the premature wearing out of the workers, and there seems to be some force in this contention. The opposition to it is, however, the fact that when the tree variously known as cabbage gum, bastard box, peppermint, &c., flowers during the winter months, bees work freely on it and come through strong. This tree, however, produces pollen freely, and, while but little brood can be reared owing to low temperatures, the nitrogen withdrawn from the body of the bee by the secretion of the enzyme which is necessary for the changing of the nectar into honey, is continuously replaced by the consumption of pollen found on the blossom from which the nectar is gathered, and thus the vigour and vitality of the bee are maintained when gathering from pollen-producing blossoms, but impaired when working on flowers producing nectar only.

Dr. Kramer, a well-known Swiss authority, states that sugar syrup (which contains no nitrogen) fed to bees and extracted contained the same amount of nitrogen as pure honey. The nitrogen was added out of the bee's own organism "That," Dr. Kramer says, "explains why after being fed sugar, bees are so eager for pollen, also why bees rapidly become enfeebled upon being fed sugar when no pollen or substitute is available" (*Gleanings in Bee-culture*, Dec. 15, 1912, page 817).

As bees do not obtain pollen from ironbark blossoms, a winter flow from that source is the equivalent to heavy sugar feeding with a lack of pollen at the same time, which, as Dr. Kramer further on in the same article says, "so rapidly decimates the colonies."

Pending the collection of further data on this subject, and the discovery of a means of supplying nitrogen artificially, beekeepers in localities liable to this trouble will be well advised to remove their colonies to some other locality during the "off year" preceding the blooming of the ironbark.

XV.—SPRING MANAGEMENT OF BEES.

During the first or second week of September, all hives should be examined for the purpose of seeing whether each one has sufficient food, a laying queen, and enough bees to enable it to work up into a profitable colony.

This examination should be made only on fine mild days, otherwise harm will be done to weak stocks, by letting the warmth escape when opening the hive and by causing the bees to fly and become chilled. Having lighted the smoker, blow one or two whiffs of smoke in at the entrance, lift the cover at one end, and blow a few puffs of smoke over the top of the frames. When quilts are used between covers and frames. hives can be opened with less disturbance, less smoke is needed, and it is consequently easier to find the queens.

The amount of stores is the first consideration of this time of year, but no hard and fast rule can be laid down as to the actual weight of honey required to maintain and develop the colony. The quantity depends upon the number of bees in the hive, the length of time which may elapse before they can find sufficient new nectar in the blossoms of the immediately surrounding country, and the weather conditions prevailing during the following four or five weeks. In no case, however, even under the most favorable circumstances, should there be less than 5 lbs. of honey (equal to one well filled Langstruth comb) in the hive. Bees build up in spring on their winter stores, excepting in specially favoured localities with a mild climate and an early flowering flora. From 15 lbs. to 25 lbs. of honey is more like the quantity required in an average locality to obtain the best results in brood-rearing till sufficient new nectar is available from outside sources. As the consumption greatly increases as soon as brood-rearing commences, any shortage should be made good by feeding sugar syrup.

If no feeders are on hand, a clean empty comb may be filled with syrup by placing it flat in a milk or other suitable dish and pouring the syrup into the cells from a height of about 15 inches. When one side is filled, the comb is turned over and the other side filled. To get a fine stream of syrup, a jug with a rather pointed lip is the most suitable vessel. When the comb is filled, it should be held or suspended over the

dish for a short time, to allow the surplus syrup to run off. The latter would otherwise fall on to the floor of the hive, and in all probability attract robbers.

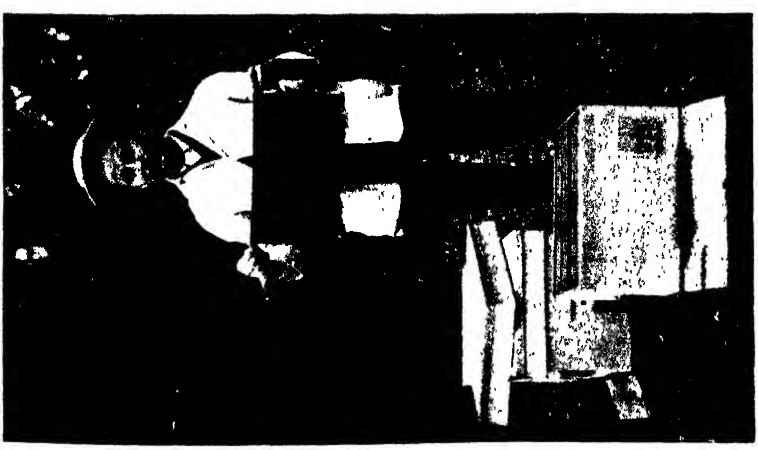
Every hive should have a fertile queen; and, as a minimum, bees on at least two or three combs. It is not absolutely necessary to see the queen, the presence of eggs and of brood in the several stages being sufficient evidence that the queen is all right. When the eggs, however, are at the side of the cell bottom, and not in the centre, laying workers instead of a queen may be present.

A further indication of laying workers, an unfertile young queen, or an exhausted old one, is that the cappings of the sealed brood, instead of being only slightly oval, are hemispherical and project much beyond the general surface of the comb. This is due to the fact that the eggs of laying workers and unfertile or exhausted queens produce drones only. The larvæ of the latter are larger than those of the workers, and being in worker instead of in drone cells there is not sufficient depth and the cell is therefore lengthened in capping it. If a hive in this condition still contains sufficient bees, and is to be retained as a separate stock, the laying workers or the drone-laying queen must be replaced with a fertile queen. With Italian bees, which are quieter than blacks, and the queen differently marked from the workers, she is usually easily found. Black queens are often very hard to find on account of their sombre colour and the habit of black bees of clumping or running off the combs when disturbed.

Correct Way of Handling Combs.

In hunting for queens, or examining brood for disease, it is necessary to see both sides of each comb. To do so, many bee-keepers turn the comb in the wrong way, resulting in a fracture of the cells near the top bar when the comb is not built right down to the bottom bar and it is at all heavy with honey. It also causes spilling when the comb contains new thin honey. A comb should never be turned on a horizontal, but always on a vertical axis. Combs fractured or strained through handling them the wrong way often mash up in the extractor. When the combs are returned to the hive the bees repair them; but, as the damaged cells, become elongated through the weight of the comb, they are large enough for drone-brood, several rows of which will be found across the comb where it was fractured when the comb is used in the brood-chamber. Combs so damaged are also very liable to come down in hot weather or in moving bees by road or rail.

If combs are handled the right way, no harm will be done to them, even when built from starters and not fastened to the bottom bar of the frame. As bees generally, and queens in particular, run to the bottom of the frame when it is lifted out of the hive, it often becomes necessary to turn the frame upside down when looking for the queen. In Fig. 1 is shown the first position; to turn the frame upside down without damaging the comb the top bar of the frame is brought into a vertical position as shown in Fig. 2; and by swinging the frame half-way round (like a door on its hinges), and then bringing the top bar into a horizontal line, the frame is completely reversed as shown in Fig. 3. As the bees again travel downwards, the queen, if she is on the particular



1. First Position.

2. Second Position.

3. Third Position.

CORRECT WAY OF HANDLING COMBS.

comb, will be noticed. To turn the comb to the hive, the same movements are again gone through, but in the reverse order of 3, 2, 1.

If, in the course of the first examination, one or more colonies are found with unfertile queens, the hives should be marked and left alone till the overhaul of all of the colonies is completed. Amongst a number of stocks of bees there are generally, at this period of the season, some which are weak in bees, though possessing a fertile queen. These queens may with advantage be used to replace unfertile ones in colonies with more bees. To transfer a queen, it is first of all necessary to find and remove the one which is to be replaced. The following day, preferably towards evening, the small stock with the fertile queen is placed alongside. Both lots are gently smoked, and the combs with brood and bees from both put into one hive, so that each comb from one is between two from the other hive. The outside combs of both are put into the other hive body which is placed on top of the first, the bees brushed off the combs, and the latter and the hive body removed. If uniting is done later in the season, the second body and combs may be left on as a super.

When no small stock with a laying queen is available, a colony with an unfertile queen may be kept going by giving it a comb of eggs, or young larvæ from a normal colony, once or twice a week, according to the number of bees. At the same time, remove one of the combs of drone larvæ and substitute it for the comb removed from the normal colony, which will usually throw out this useless brood. In this way a colony may even be gradually built up; and, when young queens are available from swarmed stocks, the valueless queen can be replaced.

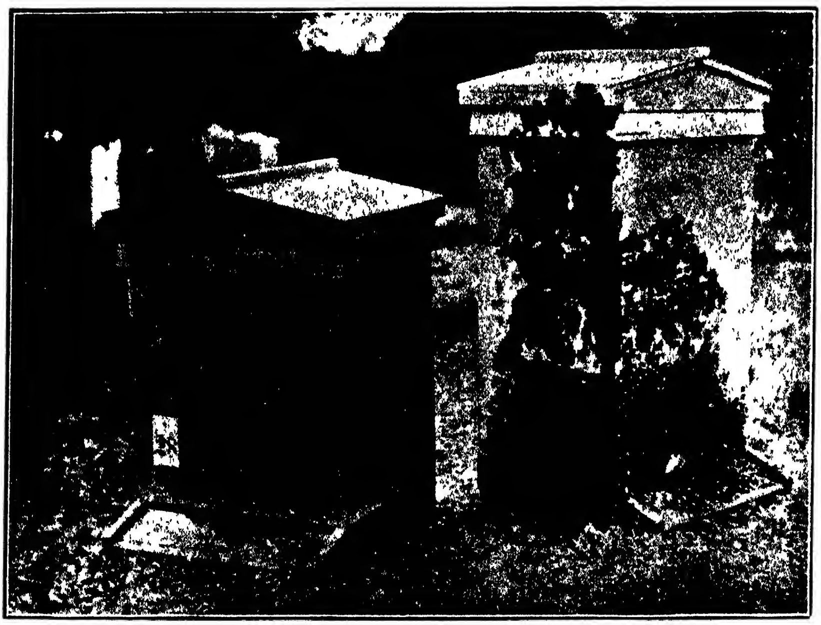
It is often very difficult to get a colony with laying workers to accept a queen, all the bees being old; but, if treated as described, there will soon be a sufficient number of young bees, and the introduction of a queen may then be safely accomplished. Colonies found queenless, and without even laying workers, should be dealt with in the same way, if still sufficiently strong enough to be worth saving.

A mistake, often made by beginners, and even by established bee-keepers, is the spreading of brood with the idea of hurrying brood-rearing. This practice of putting empty combs, or even partly filled ones, between the brood combs, more often results in loss than in gain. It is recommended in some of the text-books written for countries in which the sudden changes of temperature experienced here do not occur. During September and October, colonies have all the brood they can cover on a cold day, and spreading the combs by putting a vacant one in the middle, results in the brood in some of the outside combs perishing from chill. If it appears necessary to give room for brood, the combs should be placed, one at a time, alongside, and not between, the brood.

Under normal conditions, a colony of bees increases rapidly in strength during September and October. As soon as all the combs of the brood chamber are occupied by bees, and before they are actually crowded, the second or upper story should be put on and the bees induced to commence work in it. This is done by taking a comb containing honey from the brood chamber and putting it into the second story and directly over the brood combs, while the frame from the

upper story is placed into the brood chamber. When a colony of bees has become crowded before the super is put on, it will quite likely be inclined to swarm, and no amount of manipulation will cure it of that tendency till the swarming season is over. When bees are worked for extracted honey there is much less swarming than when comb-honey is produced.

If a maximum profit from the number of colonies kept is aimed at, the raising of comb-honey in 1 lb. sections should not be attempted in any locality which has not at least a fair honey flow. Many owners of bees find it very difficult to induce bees to work in the section supers. There are various reasons for this disinclination of the bees to enter sections. Bees at any time prefer to work together in large numbers and without any break in the combs in a vertical direction, and are



SWARM RETURNED AFTER LOSING THE QUEEN.

therefore disinclined to work at comb-building in such comparatively small clusters as the 1 lb. sections necessarily create. Further, the sections are, in many instances, supplied with very small starters of foundation, leaving a distance of 3 inches from the brood-combs to the lowest point of the starter in the section. Bees invariably store their honey just above the brood; and, instead of commencing comb-building on the small starters in the section so far away from the brood and separated from it by empty space and the woodwork of the section, they frequently store the honey they gather into the cells from which young bees emerge. This restricts brood-rearing and causes the crowding of bees in the brood chamber, which is such a fruitful source of excessive swarming.

This difficulty may be overcome by inducing the bees to enter the section, or by compelling them. Bees may be induced to enter the

section super by putting on one or more sections already partly built and containing some honey amongst the empty ones in the super. These partly filled sections are known as bait sections. When none are available, the bees may be compelled by first putting a super of full-sized frames of empty combs; or, failing this, of full sheets of foundation on the brood-chamber. If there is sealed honey along the top bar of the brood combs, the cappings of the honey may be lightly scratched with a fork, which will induce the bees to remove it and the queen to deposit eggs therein, thus bringing the brood right up to the top bar. When this stage has been reached, the bees may be brushed off the combs of the upper story and a section super put in its place. As there is now brood in the combs of the hive right up to the top bar of the frames, and as the bees want to place honey above this brood, they will, as a rule, at once commence work in the section, provided that honey is coming in.

The upper story removed from the hive may be used on another hive for a similar purpose, or as an extracting super. If it contained brood at the time of removal, the largest sheets of it may be put into the brood-chamber. Removing from the latter any combs containing little or no brood, the object being to crowd into the lower story of the section hive as much brood as possible so as to leave no room for honey. Keep the colony strong, and compel the bees to build comb and store honey in the sections. Any brood left over may be given to weaker colonies, but only as much as can be taken care of by each.

As October is the principal swarming month, a watchful eye should be kept on the hives from 10 a.m. to 3 p.m. on fine days, unless the condition of the colonies in regard to the swarming tendency is known, from a record of the ages of the queens and systematic periodical examinations to see whether swarming preparations are in progress.

While it prevents the absconding of prime or first swarms, the clipping of queens often causes trouble through the queens getting lost. The swarm returns to the hive, only to issue again, a week or so later with a virgin queen and a greater number of bees. As a virgin queen is light and has greater powers of flight, such swarms will usually settle high up in inaccessible places or abscond without clustering. It is, therefore, not advisable to clip queens, unless the hives are near a dwelling from which a view of them can be obtained, or the number of colonies is sufficient to keep a special watch on them during swarming hours. The illustration shows a hive to which the swarm has returned after losing the queen.

(*To be continued.*)

TOMATO CULTURE IN VICTORIA.

(*Continued from page 514.*)

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

Diseases.

The diseases of the tomato can be placed under three headings—(1) Insect, (2) Fungus and Bacterial. (3) Constitutional.

Insect.

Tomato Moth (*Heliothris Armigera*).—This insect is the most destructive pest of the tomato, and is world-wide in its distribution. French's handbook *Destructive Insects of Victoria*, Part III., page 48, gives a full description, and has a coloured plate, of this pest in all its stages. The eggs are laid by the moth on the leaves and young fruit, and the caterpillar attacks the fruit by boring into the flesh. One caterpillar may destroy many fruits by boring.

Spraying with arsenate of lead will be found satisfactory in dealing with this pest. Spraying should not be carried out on ripening fruit, but if performed when the caterpillars are first noticed, in early December and November, should keep the pest in check.

Cut Worms (various) -*French*, Part III., page 74.—These pests damage the young plants by eating the foliage and stems. They are closely allied to the Tomato Moth. The greyish caterpillars do not move far from the plants on which they feed at night, and are to be found sheltering in the day-time just beneath the surface of the soil, or under litter near the plants. Spraying with arsenate of lead will be found beneficial; they may also be largely reduced by placing traps of half-dead weeds among the plants; the weeds will be found to shelter the caterpillars, which should be collected and destroyed. Arsenic bait is very effective. This is prepared by thoroughly mixing 1 oz. of Paris green or arsenate of lead with 1 lb. of sweetened pollard or bran; this is placed in hollows on the ground among the growing plants. The caterpillars eat the bait readily and die.

Tomato Weevil (*Desiantha nociva*), *French*, Part V., page 41.—This is a small curculio beetle, about ¼-inch in length, of a greyish-brown colour, and causes much damage both in the grub and beetle state. The insects generally feed at night. Spraying with arsenate of lead will be found beneficial if the fruit is not ripening. The better course with this pest is to spread paper or bagging under the plants in the day-time, and in the night-time go among the plants with a shaded lantern. As soon as the light is thrown on to a plant the insects drop to the ground; they can then be gathered and destroyed. Arsenic bait will also be found beneficial.

Metallic Fruit Fly (*Lonchaea splendida*), *French*, Part V., page 21.—This fly does a deal of damage in some seasons. The writer's experience is that it follows the Tomato Moth, and it is not usual for it to attack sound fruit. A favorite point of attack is the bore made by the caterpillar of the Tomato Moth, or any crack or blemish on the

fruit. The maggots soon turn the fruit into a putrifying mass. All infected fruit should be gathered and burned.

Rutherglen Bug (*Nysius vinitor*), *French*, Part I., page 105.—This pest is a tiny light-greyish coloured bug, which appears in great numbers at times, and sucks the juice from the leaves and fruit of the plant. The bugs breed in the open grass lands. When cultivated plants such as tomatoes are attacked, it is no use spraying; smoke fires are found the best, as the smoke will drive the bugs out of the plantation. During the process of smoking the bugs should be stirred up from around the plants with an old broom or beater.

Fungus and Bacteria.

Black Rot (Spot, Black Spot), Rust (*Solani*), Macrosporium (*Alternaria*).—This disease, Black Rot, gains an entrance at the blossom end of the fruit, and causes a depression of the fruit, which at first appears brown, and later on turns to a dark velvety appearance, due to the spores which are formed on the outside of the fruit at this point. The Rust appears on the leaves, and is due to the same fungus. Small brown spots at first form on various parts of the leaves, gradually increase in size until they become large blotches, eventually involving the whole leaf. The terms Spot and Black Spot are also applied to this disease; it is the most serious disease of the tomato. Spraying with Bordeaux mixture or copper soda will be found effective. Spraying should be carried out just after the plants are transferred to the open, and have established themselves. Badly diseased plants should be uprooted and burned.

Irish Blight (*Phytophthora infestans*).—This disease, which did so much damage to the potatoes in 1911, happily did not affect the tomato crop. Its liability to attack the tomato is recognised, however, and attention should always be given to this danger.

Damping Off.—This occurs chiefly among seedlings in the cold frame, and also on plants in the open. The stem decomposes, and just level with the ground the plant topples over, hanging on to its root by the shrivelled skin. Several species of fungi which infest the soil are responsible for this condition; they live on decaying vegetable matter, but also have the power of attacking living tissue. The remedy is care and attention in the selection of soils and manures for the frames and field. Leaf-mould is a common source of infection, and should be thoroughly composted before using. When damping off occurs in the frame, water should be sparingly used, and the surface soil between the plants kept thoroughly stirred and allowed to dry out. Much of the fungi may be killed in this way.

Pimply Rot.—This disease forms black blotches on the half-grown fruit. It is readily distinguishable from Black Rot, as the infected part is usually more or less circular in form, and remains smooth and glossy for a good while after the fruit is attacked. Later on concentric rings show round the central portion, the whole forming a flattened, sunken patch, taking up, sometimes, nearly the whole side of the fruit. This disease commences anywhere on the fruit. Spraying, so far, has not proved of any use against this disease. Infected fruits should be gathered and burned.

CONSTITUTIONAL.

Rosette of the Tomato.—With this disease the large-growing plants are attacked. The new foliage is turned into aborted leaves, forming irregular masses or clusters, and often turning the whole plant into a mass of aborted growth, with well-defined rosettes on the extremities of the leaders and laterals. There is no known remedy for this disorder; infested plants should be eradicated and burned.

Leaf Curl, or Fiery Blight.—With this affection the leaves curl up and expose the under surface to the light, the midrib and veins become distended, and the leaves easily break if bent quickly. The old leaves are generally the first affected; sometimes the whole plant is attacked, and where this occurs the plant fails to bear a normal crop of fruit. The buds either fall or the fruit fails to set. The causes chiefly conducive to this malady are—Excesive amount of water in irrigating; over fertilizing the soil with green stable manure, causing a soft, vigorous growth of stem and leaf; pinching or cutting of laterals and leader growth on too strongly growing plants. None of these may cause damage singly, but if two or three act together, then the grower may look for this disorder among the plants.

In treating diseases, I find that growers are very neglectful of the ordinary methods of clean culture, especially with regard to the destruction of diseased plants and fruit. Diseased fruit and plants should always be destroyed by burning, and not allowed to lie on the ground. Spraying for diseases, both insect and fungus, is to a large extent neglected. I am quite confident that the tomato grower can increase his output per acre to a very considerable extent by more attention to spraying and destruction of diseased fruit, and his motto should be to increase his profits by avoiding his losses.

[With regard to grading tomatoes the following extract from the letter of a New Zealand grower is of interest, he says, "We grade into 3 grades, Choice, No. 1, and No. 2, and that is the reason why our prices kept up. When tomatoes from other growers were only making 1s. 6d. to 2s. a 24-lb. case mine were 3d. to 4d. per lb. for choice, 2½d. for No. 1, and 1½d. to 1d. for No. 2 or sauce grade. It pays to grade and pack well; not only does this apply to tomatoes but also to other fruit."—EDITOR.]

ROOT crops become more digestible as they mature, but fodder crops develop woody fibre on ripening.

IF too much superphosphate is used at seed-time the excess will not be washed away. It will remain in the surface soil, and slowly benefit succeeding crops.

IN order to keep cultivated soils in condition it is necessary to maintain the supply of humus. This can often best be done by ploughing in green manure.

WHEN PLANTS WILT—

When a crop begins to wilt the soil still contains some water. But different soils vary in the readiness with which they give up their water to a growing crop. Thus Sachs found that wilting did not begin on a sandy soil till only 1.5 per cent. of water remained, while it started on a clay soil which still contained 8 per cent. of water, and on a mixture of sand and humus with even 12.3 per cent. It might be concluded from this that sandy soils were better suited than clay and peaty soils to withstand drought, because the former could give more of their water up. The facts, however, are otherwise, because the clay and peaty soils are able to store up much more water to begin with, and as a net result they have more to give away. The stage of soil dryness at which plants begin to wilt is not, however, as is sometimes supposed, dependent merely upon the physical character of the soil, because the relative humidity, or, more precisely, the evaporating power of the air, has a marked effect. The *Plant World* describes experiments showing how atmospheric conditions affect wilting. Plants exposed in the open to the direct rays of the sun wilted sooner than when placed under a lath shelter, those sooner than when placed in a walled house, and those again sooner than when placed in a glass chamber nearly saturated with water vapour. The practical benefit of one season's rainfall is dependent, therefore, not only upon its amount and distribution, but also upon the evaporating power of the atmosphere particularly during the period of active growth. In order to measure this and so co-relate it with the annual rainfall and crop yields, three evaporation gauges have been installed on the Government farms at Werribee, Wyuna, and Rutherglen, in addition to the ordinary meteorological instruments of a first class station.

STANDARD TEST COWS.

FIRST REPORT ON GOVERNMENT HERD TESTING AND CERTIFICATION OF STANDARD COWS.

For Period Ending 30th June, 1913.

By W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.

In submitting this, the First Report of the Herd Testing Scheme, as carried out by this Department, it is opportune to briefly trace the steps which led to its successful launching.

In nearly all countries in which the dairying industry has been highly developed, associations of one form or another are in existence for the testing of the individual cow. Some of these associations confine themselves to tests covering a short period only. It is, however, becoming more and more evident that, in order to obtain reliable data, the recording of weight of milk must be done daily, and the test must cover a full milking period, and continue from one season to another; for it is well known that great variations may occur in the returns at different stages of lactation and during different calving periods. All progressive dairy farmers are familiar with the conformation which for generations has been regarded as an indication of milking qualities; and most are also familiar with the fact that reliance cannot regularly be placed on type and form as indicative of milking capacity, and oftentimes buyers may be landed with a duffer; but just as the external form is handed down from one generation to another, so also is the capacity for milk production, which, on external appearance, cannot be truly predicted. It is, therefore, only by means of testing over a period, and under careful observation, that the capacity for transmitting milking qualities can be determined.

The scheme for the Government certification of standard cows, which was inaugurated last year, is confined to the testing of pedigreed herds of the various dairy breeds under the strictest conditions practicable, as set out in the regulations hereto. The object designed to be attained is that purchasers of bulls of any dairy breed may be assured concerning the milk and butter yielding capacity of the dams. Oftentimes in the past great disappointment has been experienced by purchasers of bulls from pedigreed herds by reason of their failure to improve the milking capacity of the progeny of cows upon which they have been used. Greater reliance has been placed upon show yard points and so-called milking type than upon actual milking records, and, indeed, the practice of recording milk yields of pedigreed herds has not been at all common in this State, so that the owners were not in a position to give any records to purchasers. It is anticipated that when the scheme comes into full operation dairymen will pay much greater attention to the milking record of the dams in the pedigree than their show yard honours.

For the period which this report covers, terminating on 30th June, 1913, fifteen herds have been entered. The breeder who was first to recognise in a practical manner the benefits to be derived from the test, and to whom must go the honour of being the first to enter his herd, is Mr. F. J. Stansmore, of Pomborneit, who entered, on 14th May, 1912, his Aryshire herd. He was shortly followed by Messrs. P. E. Keam and C. G. Lyon.

There were many other breeders who, though realizing the benefits to accrue from holding official records for their cattle, were, for various reasons, unable to immediately participate by entering their herds. As the test covers a period of nine months, only those cows which were entered prior to October last can be considered, consequently only a small number have had an opportunity of qualifying for the certificate.

The first samples were taken on the 3rd July, 1913, from the herd of Mr. C. Gordon Lyon; and the herds of Messrs. Stansmore, Keam, and Read were tested soon after, in the order mentioned. Up to the present the butter fat yield (completed or incomplete) of 180 cows is in the possession of the Department, though this number comprises only eight herds of the fifteen entered. The remaining seven herds commenced the test at a later period. The approximate number of cows which will be tested in the fifteen herds is 400. Representatives of most breeds have been entered, viz., Jersey, Ayrshire, Red Poll, Shorthorn, and Dexter Kerry, and the figures already on record indicate that no one breed has quite a monopoly as first-class butter producers. Up to date sixty-two cows have completed their term, and of these all but seventeen qualified for the certificate.

The details of the individual herds are shown hereunder:-

STANSMORE, F. J., Pomborneit (AYRSHIRE).

Cows Entered, 64; Term Completed, 31; Certificated, 18.

Name of Standard Cow	Herd Book No	Date of Calving.	Date of Entry to Test.	No. of Days in Test	Weight of Milk Last Day of Test	Weight of Milk	Average Test.	Butter Fat	Estimated Weight of
					lbs.	lbs		lbs	lbs.
Rose of Yalart	1659	22 5 12	25.6 12*	267	8	7,573	4 12	311¼	355¼
†Leonora of Yalart	2719	28.5.12	25.6 12*	237	1½	5,064	3 79	192	218¾
Berylan	2714	1 6 12	25 6 12*	236	1	5,174	4 78	247¾	282¼
Dimple of Caulfield	2715	8.6.12	25.6.12*	242	4	4,524	5 69	257¾	293¾
Nice of Caulfield	2722	11.6.12	25.6.12*	242	2	4,886	4 69	229½	261¾
Princess Edith of Oakvale	2725	18.6.12	25.6.12*	273	4	5,922	3 8	225	256¼
Julia of Yalart	2718	1.7.12	15.7 12*	223	1	4,417	4·74	209¼	238¾
Ida of Yalart	2717	1.7.12	8.7.12	273	8	5,968	4 88	291¾	332¾
Rose of Lake View	2727	4 7 12	15.7.12*	254	10¾	7,266	4 14	301½	343¾
Red Lass of Caulfield	2726	13.7 12	20.7.12	259	9¼	6,215	4 32	268¾	306¾
†Roxana of Yalart	2604	17.7.12	26.7.12*	223	2	3,747	4 3	161¼	184
†Lydia of Yalart	2721	22.7.12	29.7.12*	251	4	4,169	3 9	162¾	185¼
Lily II. of Oakvale	2720	22 7.12	31.7.12*	204	2	5,403	3 99	215¼	245¾
†Fury of Yalart	2716	24 7 12	1.8.12	195	1	4,082	4 56	186¼	212¾
†Peggy of Yalart	2724	24.7 12	1.8.12	248	3½	4,659	4 53	211	240¾
†Amy of Yalart	2603	27 7 12	3.8.12	247	7	4,583	4 4	201½	229¾
†Optic of Yalart	2723	6.8.12	13.8.12	194	1½	3,632	4 43	161	183¾
Lady Ada Douglas	2387	20.8.12	27.8 12	235	4	5,293	4·61	244¼	278¾

* Weights not recorded earlier.
† Heifer.

LYON, GORDON, Heidelberg (JERSEY).

Cows Entered, 15; Term Completed, 9; Certificated, 8.

Name of Standard Cow.	Herd Book No	Date of Calving.	Date of Entry to Test	No. of Days in Test.	Weight of Milk Last Day of Test	Weight of Milk	Average Test	Butter Fat	Estimated Weight of Butter
					lbs	lbs		lbs	lbs.
Lassie II	1136	10 5 12	7 6 12*	273	19½	6,650	4 9	326¼	372
Kathleen II	1104	26 6 12	3.7 12	273	13½	5,452	4 75	258¾	294¼
Silvermine V	1386	4 7 12	14 7 12†	273	11½	5,645	4 66	263	300
Molly II	614	16 7.12	23 7 12	273	17½	7,440½	4 85	361	411½
Silvermine IV	716	14 9 12	22 9 12†	273	20½	7,591¾	5 12	388	443¼
May II	568	30 8 12	8 9 1_†	273	11	5,804½	4 32	250¾	286
Lassie	509	12 9 12	22 9 12†	273	17¾	7,340	5 08	372¾	425
Audrey Lassie	825	2 9 12	9 9 12	273	10¾	4,854¾	5.2	252½	287¾

* Had mammitis
† Weights not recorded earlie

KEAM, P. E., Heidelberg (JERSEY).

Cows Entered, 21; Term Completed, 8; Certificated, 6.

Name of Standard Cow	Herd Book No	Date of Calving	Date of Entry to Test	No. of Days in Test.	Weight of Milk Last Day of Test	Weight of Milk	Average Test	Butter Fat	Estimated Weight of Butter
					lbs	lbs		lbs	lbs.
Fancy of Glenard	1939	11 7 12	18 7 12	248	3	3,419¼	6 05	206	235
Princess II.	Not yet allotted	23 7 12	11 8 12*	273	13¼	5,783	4 27	246¾	281
†Olive	,,	15.8 12	22 8 12	247	11¼	3,962¼	5 66	224½	256‡
Lady II.	2158	16 8 12	28.11 12*	273	16¼	7,019	4 24	298	339
Wilful Venture	Not yet allotted	20 8 12	31.8 12*	273	14¼	6,381¾	5 95	379¾	433
Jersey Maid	2114	31 8 12	7.9 12	273	10	4,122¾	5 34	230	262¼

* Weights not recorded earlier
† Heifer
‡ 247 days' test, as first 26 days' weights not furnished.

DEPARTMENT OF AGRICULTURE, Boisdale (RED POLLS).

Cows Entered, 9; Term Completed, 4; Certificated, 4.

Name of Standard Cow.	Herd Book No	Date of Calving.	Date of Entry to Test	No. of Days in Test.	Weight of Milk Last Day of Test	Weight of Milk	Average Test.	Butter Fat	Estimated Weight of Butter.
					lbs.	lbs		lbs.	lbs.
Havana	Not yet allotted	21 8 12	28 8.12	256	2	6,060¼	4 17	253	288¼
*India	,,	27.8 12	4 9.12	267	7	5,231	4·55	238¼	271½
Cigarette	,,	15.9.12	22.9 12	273	6	6,813	4 09	278½	317½
Pennsylvania	,,	16.9 12	23.9.12	228	3	4,979¾	4 32	215	245¼

* Heifer.

READ, J. D., Springhurst (JERSEY).

Cows Entered, 14; Term Completed, 10; Certificated, 9.

Name of Standard Cow.	Herd Book No.	Date of Calving	Date of Entry to Test	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk	Average Test	Butter Fat	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
Graceful Magnet of Springhurst	2058	18 7 12	25 7 12	273	10½	5,887	5 13	302	344
Beauty of Springhurst	1567	31 7 12	7 8 12	273	13½	5,388	5 27	283¾	323½
Alsyke of Springhurst	1515	6 8 12	13 8 12	273	13½	4,837	5 17	250¼	285¼
Stockings of Springhurst	2663	10 8 12	17 8 12	273	13¼	5,047	5 27	266	303¼
Euroa of Springhurst	1918	15 8 12	22 8 12	273	6¼	5,007	5 08	254¼	290
Dulcie of Springhurst	1878	15 8 12	22 8 12	273	13	5,276	5 53	291¾	332¼
*Daphne of Springhurst	1803	19 8 12	27 8 12†	273	12½	3,917	5 75	225¼	257
Aster of Springhurst	1540	17 9 12	27 9 12†	273	5¼	4,921	5 17	254½	290¼
*Tulip of Springhurst	2730	19 9 12	27 9 12†	273	6½	4,550	5 63	256¼	292

* Heifer.
† Weights not recorded earlier.

Brisbane, W. P., Weerite (Aryshires)—

Cows entered .. .. 16 Term completed . .. Nil

Cows are doing well, but none has yet completed the term, as the herd was only entered in March this year. The figures available indicate that the herd contains some particularly high yielders.

Curnick, F., Malvern (Jersey)—

Cows entered .. 2 Term completed .. .. Nil

These two cows are mother and daughter, and are both well over amount required for a certificate, though term not yet completed.

Geelong Harbor Trust (Aryshires)—

Cows entered .. .. 9 Term completed . .. Nil

Only recently entered.

Woodmason, Wm., Malvern (Jersey)—

Cows entered .. .. 13 Term completed .. . Nil

As this herd is of comparatively recent entry, no completed record is available, but the figures already in possesion of the Department are sufficient to show that many members of the herd will prove their utility.

Robinson, T., Ivanhoe (Aryshire) Saddler, D., Camperdown (Aryshire) Manifold, W. T., Purrumbete (Shorthorn) McGarve, W. A., Pomborneit (Jersey) Stone, A. R., Brighton (Jersey) Beckwith, B. M., Kooyong (Dexter Kerry)	Entry too recent for test to be recorded in this report.

REGULATIONS CONCERNING HERD TESTING

FOR THE

GOVERNMENT CERTIFICATION OF STANDARD COWS.

Entrance.

1. The owner of any herd of pure bred dairy cattle may submit his herd for certification.

2. Only those cows registered in a recognised herd book or pure stock register will be accepted, and all such cows in the herd must be tested, with such exceptions as are set out in clauses 14, 15, and 16.

3. An annual fee of £1 per herd and 5s. per cow tested shall be paid to the Department of Agriculture on demand.

4. Any cow entered for certification may be branded in such manner as to insure identification, and all standard cows will be marked on the inside of an ear with the Government tattoo mark and an identification number.

LACTATION PERIOD.

5. Testing and recording shall occupy a period of nine calendar months, commencing one week from date of calving, excepting under such circumstances as set forth in clause 18. This period shall be recognised as the official lactation period.

RECORDING.

6. The milk from each cow entered shall be weighed separately immediately after each milking by means of tested and approved scales, and the weight recorded on a printed chart supplied for the purpose, which shall remain the property of the Department. Such scales and chart shall be available for inspection by a Government Dairy Supervisor when required.

SUPERVISION.

7. A Government Dairy Supervisor, under the direction of the Chief Veterinary Officer, will make periodical visits for the purpose of checking records and taking samples of milk for testing. There shall be not less than nine visits during the official lactation period, and not more than thirty days shall elapse between any two visits. Additional visits may be made at any time by the Supervisor for the purpose of taking supplementary records and samples for testing as often as may be deemed advisable.

8. Every facility shall be afforded Government Officers in carrying out their duties under these Regulations, and accommodation must be provided over-night when required.

9. Particulars as to date of calving, service, drying-off, hours of milking, manner of feeding, must be supplied for record purposes on request of the Dairy Supervisor. If deemed necessary in any case, the owner may be called upon to furnish a statutory declaration as to the correctness of such or any particulars.

TESTING.

10. In collecting samples for testing, the morning and evening milk will be taken; the tests will be made by the Chemist for Agriculture or his Deputy from a composite sample containing quantities of the morning and evening milk proportionate to the respective yields, and the results, unless shown to be abnormal, shall be considered as the average for the period intervening since the next previous normal test. If apparently abnormal, the results may be discarded, and further samples taken and tests made.

STANDARD COWS.

11. Standard cows under these Regulations shall be those which, during the official lactation period, yield—

- (*a*) in the case of cows commencing their first lactation period and being then under 3 years of age, 150 lbs. of butter fat;
- (*b*) In the case of cows commencing their first lactation period and being then over 3 years of age, 200 lbs. of butter fat;
- (*c*) in the case of cows of any age commencing any lactation period other than the first, 200 lbs. of butter fat.

CERTIFICATION.

12. A Government Certificate shall be issued in respect of all standard cows. Such certificate shall show the breed, the age at entry, brands, the official lactation period recorded, and date of completion, the weight of milk given, the amount of butter fat and commercial butter (estimated on a 14 per cent. overrun), and the weight of milk given on the last day of the official lactation period.

13. The Certificate issued in respect of any standard cow shall, if she attain the standard during any subsequent official lactation period, be returned to the Department, when a fresh certificate will be issued, which shall show her record for each and every lactation period in which she was tested.

EXEMPTIONS.

14. Cows eight years old or over whose yields have been recorded for three official lactation periods may be exempt.

15. Aged or injured cows in the herd at time of entry, and kept for breeding purposes, may be exempt on the recommendation of the Government Supervisor. Any injury interfering with lactation received subsequent to entry may be recorded on Certificate issued.

16. Any cow which, on veterinary examination, is found to be affected with tuberculosis shall be withdrawn from the test, and her milk shall not be allowed to be used for sale, or for the preparation of any dairy produce for sale.

17. Any cow which, on veterinary examination, is found to be affected with actinomycosis of the udder, or any other disease or condition which may temporarily render her milk injurious, may remain in the herd for testing, but her milk shall not be used for sale or for the preparation of any dairy produce for sale without permission of the Supervisor.

18. When any newly-calved cow is rendered temporarily unfit for testing by being affected with milk fever, mammitis, retention of placenta, or other ailment affecting newly-calved cows, the period elapsing between the calving and entrance to the official lactation period may be extended on the recommendation of a Veterinary Officer or Supervisor, but such period shall not exceed one month from date of calving.

19. Any interpretation or decision in respect of these Regulations, or in respect of any matter concerning the Certification, which receives the written approval of the Director of Agriculture, shall be final.

20. Should the owner of any herd entered not conform to these Regulations, such herd shall be subject to disqualification for such period as the Minister shall determine. The Minister retains the right to withdraw any Certificate when, to his satisfaction, good and sufficient cause is shown.

SEPARATING TEMPERATURES—

In a recent issue of *Hoard's Dairyman,* Mr. J. H. Monrad, of Denmark, gives some interesting notes upon the effect of temperature on the work of the cream separator. In Denmark cream and skim milk must, under the law, be heated to at least 176 degrees Fahr. for pasteurizing, and thus the milk can be separated at a high temperature if this is desirable. As a fact, the normal separating temperature in Denmark may be placed at about 131 degrees. Experiments at the Royal agricultural laboratory in 1910 showed, however, that this temperature was little superior to 95 degrees, which is about the temperature of freshly-drawn milk, the difference amounting to only .006 per cent. in favour of the warmer milk. The difference, however, became much more pronounced when the temperature was allowed to drop below 95 degrees, and German experiments are quoted showing that at 86 degrees there was .2 per cent. fat left in the milk, at 68 degrees there was .3 per cent., and at 50 degrees there was .6 per cent. left. Altogether, the data quoted show that freshly-drawn milk is warm enough for practical purposes, but that when the milk has been cooled by standing, the work of the separator is decidedly less efficient.

THE FRUIT TRADE OF VICTORIA:

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page* 511.)

PART X.—PACKING.

By E. Meeking, Senior Fruit Inspector.

A Plea for the Introduction of the Diagonal-numerical System of Packing Apples.

The old adage "Show me a man's friends and I'll tell you his character," may well be transposed for application in a business sense by saying "Show me a man's goods and I'll judge his commercial status." This is particularly the case in an industry such as our oversea fruit export trade, in which our fruits are consigned to markets at the other end of the world, and where the buyer (who seldom or never comes into personal contact with the producer or seller) has no standard whereunder he may judge the commercial standing of the latter except by the general appearance and quality of his wares. The contention often quoted by many of our exporters, that buyers on the London and Continental markets take no note of the appearance and make-up of the packages enclosing our fruits, but that these solely judge the fruits on their own merits, is not altogether correct. Packages encasing commodities such as fresh fruits which are sold in their original containers are, from a marketing point of view, part and parcel of the goods themselves, and the attractiveness, or otherwise, of the packages may rightly be considered as having a great influence on the mind of the buyer—in short, to be a factor of prime importance in determining the value of the goods. Fruits carefully graded with regard to size, colour, and general quality, put up in distinctive and attractive packages, and branded with grade marks, in a sense, sell themselves, as they save the agent and buyer an infinite amount of trouble in determining their value. Of course, bad fruit cannot be expected to realize high prices, even if enclosed in good packages, but, all other things being equal, there is little doubt that consignments put up in attractive manner will realize better prices than will consignments where such has been neglected.

The object is to show that up to now sufficient consideration has not been given by our exporters to this aspect of the subject, nor, also, to the fact that the introduction of new and improved methods, both in the style of package used and in the manner in which our fruits are packed, is of urgent necessity if we wish to maintain the position we have already established in connexion with our oversea fruit export industry on the London and Continental markets. It is intended to further show that the best means whereby this desirable end may be attained will be by the general adoption of the so-called numerical system of packing fruit.

History of Numerical Packing.

This system originated some years ago in California in connexion with the packing of oranges for transport over long distances. The

pack, which was termed the "diagonal pack," was not at first instituted with the idea of adopting a numerical standard, but was used because it furnished the best system of putting up fruits with the maximum of tightness combined with a minimum of bruising. It was later discovered that, in order to put up fruits of various grades, a numerical system of packing could be applied under the diagonal pack. After California had been packing for some time under the numerical system, the advantages, from a marketing point of view, were so obvious that the system gradually spread through the Western States of the United States and Canada, being voluntarily adopted by the growers themselves, and its superiority over the older methods is now so universally acknowledged that it has been made the subject of legislation within the past three or four years in both countries of the American Continent.

Capacity Standards and Numerical Standards Contrasted.

In this country an attempt has been made to protect the purchaser by the passage through the Legislature in 1906 of the Fruit Cases Act. Under this measure, cases of various sizes based upon the imperial bushel standard have been adopted. In order to suit the packing of different varieties of fruits, and also to meet the varying requirements of the local, Inter-State, and oversea export trades, these packages vary in shapes as well as measurements; but the cubical capacities of all cases have been fixed to provide that, as nearly as possible, these shall contain, by measurement, either two bushels, one bushel, or one-half bushel of fruit as may be required. Although these standards by measurement are a great advance on the old haphazard methods of putting up fruits in any sized packages, and although they have proved of much benefit to the trade by suppressing, or, at least, lessening the dishonest practice of selling fruit in undersized cases, yet it would appear that, for many fruits to which a numerical standard may be applied, the capacity standard does not nearly give so good a guarantee to the purchaser as does the numerical standard. This is particularly so when, under the numerical system, the purchaser becomes thoroughly acquainted with the meanings of the trade descriptions which are placed on the outside of packages. Before proceeding to explain why this is so, it may be well to state that, while the wholesale trade, and particularly the oversea export section of that trade, is under review, yet the numerical system is also eminently adapted for a local single case retail trade. In the Western States of the North American Continent, two sizes of cases, or boxes, as they are termed in America, have in the past been generally adopted by the growers for numerical packing. These are respectively called the "standard," or Washington box, and the "special," or Canadian box. The inside measurements of these boxes are as follows:—

"Standard" (Washington), 10½ in. x 11½ in. x 18 in. = 2,173 cubic inches.

"Special" (Canadian), 10 in. x 11 in. x 20 in. = 2,200 cubic inches.

They are usually constructed of spruce or pine cut as follows:— Ends, ¾ in.; sides, ⅜ in. (one piece each). Tops and bottoms (two pieces each), 3-10 in. to ¼ in., according to the strength of the material used. Growers in the Western States of America in the past used both boxes, because it was considered that both sizes of packages were

necessary to provide for the packing of all grades of fruit. This idea is now, however, discarded, as it has been found that for all practical purposes the Canadian case is sufficient. For shipping purposes they should go twenty-four boxes to the ton (40 cubic feet measurement). The tops and bottoms are fastened with four cleats, each ⅜ in. x ¾ in. x 11 in.

General Description of Various Kinds of Numerical Packs.

In packing under the numerical system, three kinds of pack are used, viz., the 2-1 pack, the 2-2 pack, and the 3-2 pack. The 2-1 pack is so called because the fruits, in counting the rows laterally, are arranged from one end of the box to the other in two long rows, plus one short row, or two short rows, plus one long row, as the case may be. It thus takes three apples to reach diagonally across the full width of the box.* This pack is seldom used in the Canadian box, as this

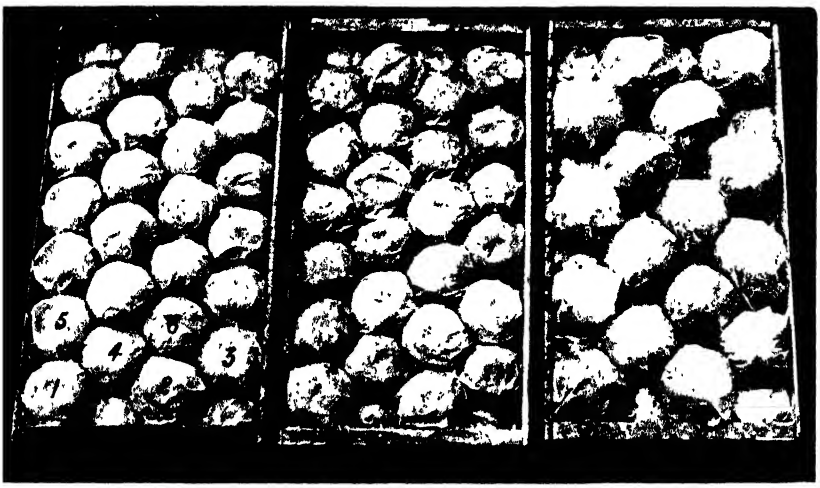


Plate I.

Fig (*a*).
2 × 2 pack, 4 tier, 6–6 rows
24 apples to tier
4 tiers=96 apples to case

Fig. (*b*).
2 × 2 pack, 3½ tier, 4–4 rows
24 apples to tier
64 apples to case.

box is too wide to permit any but the largest sized apples to reach right across the case in diagonal rows of three. It may, however, be widely used in the Australian so-called "dump" case. In the 2-2 pack the fruits are arranged in rows of two across the box. It thus takes four fruits of this pack to reach diagonally from one side of the box to the other (Plate I.). In the 3-2 pack, if the count is commenced at one end of the box and counted horizontally to the other end, it will be seen that the apples are arranged horizontally in rows of 3's and 2's alternately, and that it takes five fruits to reach diagonally from one side of the box to the other (Plates II. and III.). The fruits in all the above packs should be so arranged that the rows run in direct lines lengthways, and also in straight lines diagonally. For instance, in describing a pack, we might say that it was a 2-2, 4-4, or a 3-2, 8-8 pack. This would indicate that in the first instance there would be four rows with four fruits in each row, making a total of

* Seen in subsequent article, Plate VI.

sixteen to a layer (Plate I., Fig. *b*). As in the Canadian case, all 2-2 packs are four layers, or tiers, as they are named in America, deep, we would thus, in the pack under notice, have 16 x 4, or a total of 64 apples to the case. In the second instance there would be two rows containing eight fruits, and three rows containing eight fruits= 8 + 8 + 8 + 8 + 8, making a total of 40 fruits to the tier. With five tiers of apples in the case, this would give us 40 × 5=200 fruits to the case (Plate II., Fig. *a*). In the 2-1 and 3-2 packs a variation in the number of apples to the tier is often necessary. These will be described more fully later in the explanatory notes on the various schedules. To start the 2-1 pack, the first fruit must be placed in one of the corners at the end of the box nearest the packer. The left-hand corner is the one usually chosen for this and all other packs. The second fruit should be placed in the opposite right-hand corner.

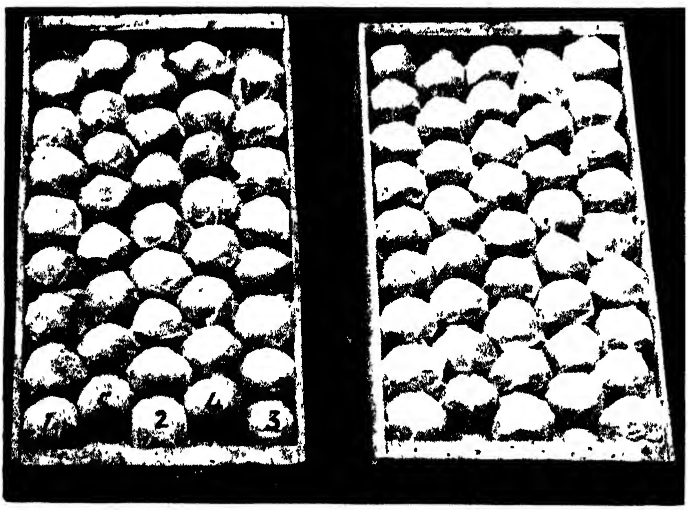


Fig. (*a*) Fig. (*b*)

Plate II.

3 × 2—5 tier packs

(*a*) 8 × 8 rows 5 tiers to case 200 apples

(*b*) 8 × 9 rows, 5 tiers to case=213 apples.

The third fruit should be placed between these two fruits, and the fourth fruit should be placed in line with fruit No. 1 (*i.e.*, in the left-hand corner), at the end nearest the packer.* To start the 2-2 pack, the first fruit should be placed in the left-hand corner of the end of the case nearest the packer. The second fruit should be placed against the end of the box about midway between the edge of the first fruit and the opposite side. The third and fourth fruits are fitted into the spaces between the first and second placed fruits (Plate I.). If these first four apples are carefully packed, the rows of the tier fill easily. In the 3-2 pack, a fruit is placed in each corner, with a third apple midway between. The fourth and fifth fruits are placed in the two spaces between the first three fruits (Plates III. and VI.). In all these packs, when the first tier is completed, it should be sufficiently tight to permit the box being held on

* Seen in subsequent article, Plate VI.

end without the fruit falling out. To obtain the requisite tightness of the first tier, the apples should be placed in position rather loosely until the apples in the last rows of the tier are to be placed in the case. The portion of the tier already packed should then be tightened by the packer inserting his hands at the end of the tier and pulling the apples towards himself. The remaining appples required to complete the tier should then be inserted at the end of the case farthest from the packer. After the first tier has been packed, the second tier should be so packed that no fruits in this tier should directly rest upon the fruits in the tier below. This principle should be observed throughout, until the packing of the box is completed. The rows should be straight, both lengthways and diagonally.

The apples must be carefully selected with regard to uniformity in size, colour, and general quality, if an attractive and properly packed case of fruit is desired. If the fruits are not carefully selected with regard to equality in size before being placed in the case, the

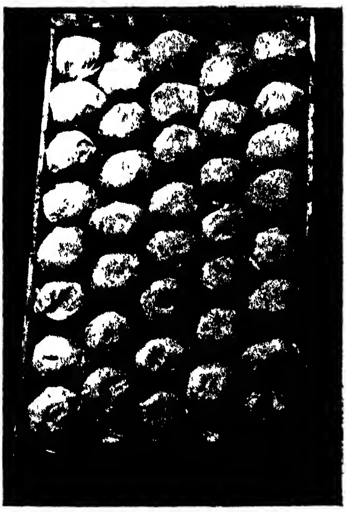


Fig (*a*)—1st, 3rd, and 5th tiers=38 apples to tier

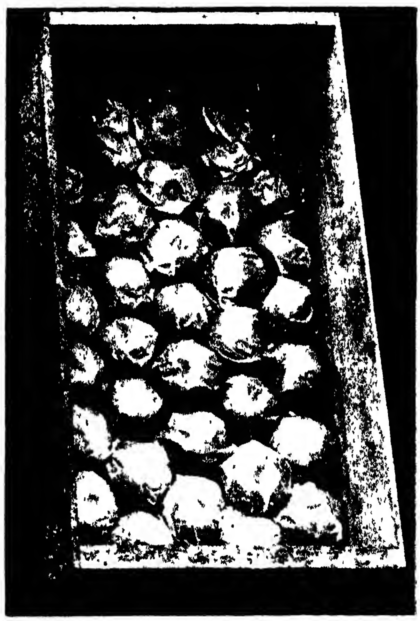


Fig. (*b*)—2nd and 4th tiers=37 apples to tier.

PLATE III.

3 × 2 pack, 4½ tiers, 8–7 rows, 38 and 37 apples to alternate tiers–5 tiers=188 apples.

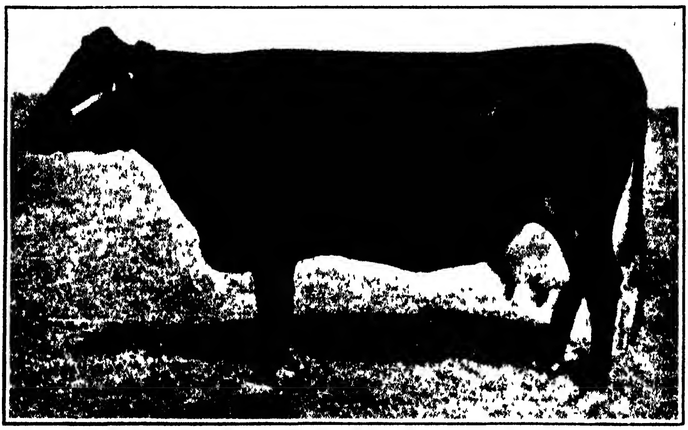
required number corresponding to the grade of the fruit cannot be packed. For example, if it was intended, when commencing to pack the case, to pack 175 fruits, this could not be accomplished if the packer were to introduce fruits which rightly belong to the grade which would run 200 fruits to the case. He would discover that his pack would be thrown out of line in many directions, and a buyer on examining the top layer would know at a glance that the case was incorrectly packed, even if the trade description indicated that the case contained the requisite number (175 fruits).

(*To be continued.*)

RED POLLS FOR DAIRYING

By Dr. S. S. Cameron, Director of Agriculture.

As milkers, the Red Poll herd established by the Department of Agriculture four years ago is maintaining the early promise of becoming a factor in the improvement of the dairy herds of the State. It will be recalled that in 1910-11 the average milk yield of the herd for an average milking period of thirty-seven and a half weeks was 5,750 lbs., and in 1911-12, with an average milking period of forty weeks, 6,355 lbs. For the year just closed, 1912-13, the records are still very good, although the average (5,218 lbs.) is somewhat lower, on account of the inclusion in the herd of a number of heifers milking for the first time, and also because of the untoward conditions under which the herd was milked for the greater part of the year, the summer drought at Boisdale and the dry, scant pastures at Rutherglen



One of Lord Rothschild's Red Poll Milkers.

Milk yield 1908, 10,186 lbs.; 1909, 9,595 lbs.; 1910, 11,450 lbs.

being markedly detrimental to record-raising. A feature of the herd, however, which is even more satisfactory than the comparatively high milk yield under the adverse conditions, is that the butter fat tests have been as uniformly high this season as during previous seasons. In 1911-12, the average test ranged from 4.31 to 5.95, the three highest cows going 5.2 to 8.2 (Vuelta), 4.4 to 8.4 (Cuba), and 4.5 to 7.0 (Muria). Three other cows regularly tested over 6 per cent. towards the close of their milking period, viz.: Connecticut, 4.6 to 6.4; Beulah, 4.9 to 6.4; and Bullion, 4.8 to 6.2. This season (1912-13) the high testing capacity of the herd has again been demonstrated, and two heifers, viz., India and Birdseye, have run the best of the older cows very close for the record of the herd. India's test has ranged from 4.1 to 6.2, and Birdseye's from 3.9 to 8.0, the latter on three successive evening milkings giving the extraordinary tests of 9.4, 9.5, 9.7. All the tests referred to above, and set out in the tables below, are composite tests of the morning's and evening's milk taken under Government standard conditions. Some of the heifers, too, appear likely to carry on the fame

of their dams as regards milk yield, Goldleaf, a daughter of Bullion (7,733 lbs. record), having yielded 6,437 lbs. during the Standard Test period of nine months, with a butter fat test ranging from 4.1 to 5.3. She calved at two years and two months old, and is due to calve again at three years and one month. Her yield of butter fat, viz., 308.5 lbs., is so far the best of all the heifers that have completed the nine months' milking under Standard Test conditions.

Satisfaction appears to have been given by the system that has been adopted for fixing the price of the bull calves, viz., the value of the annual butter fat yield of the dam at 1s. per lb. Thus Bullion yielded 357 lbs. of butter fat, and her calf was sold at £17 17s.; Havana yielded 230 lbs. of butter fat, and her calf was sold for £11 11s. Bull calves ex cows on their first milking, and in respect of which there is therefore no record available other than that of the grand dam, are sold for a uniform price of 5 guineas; and this last season the purchasers under

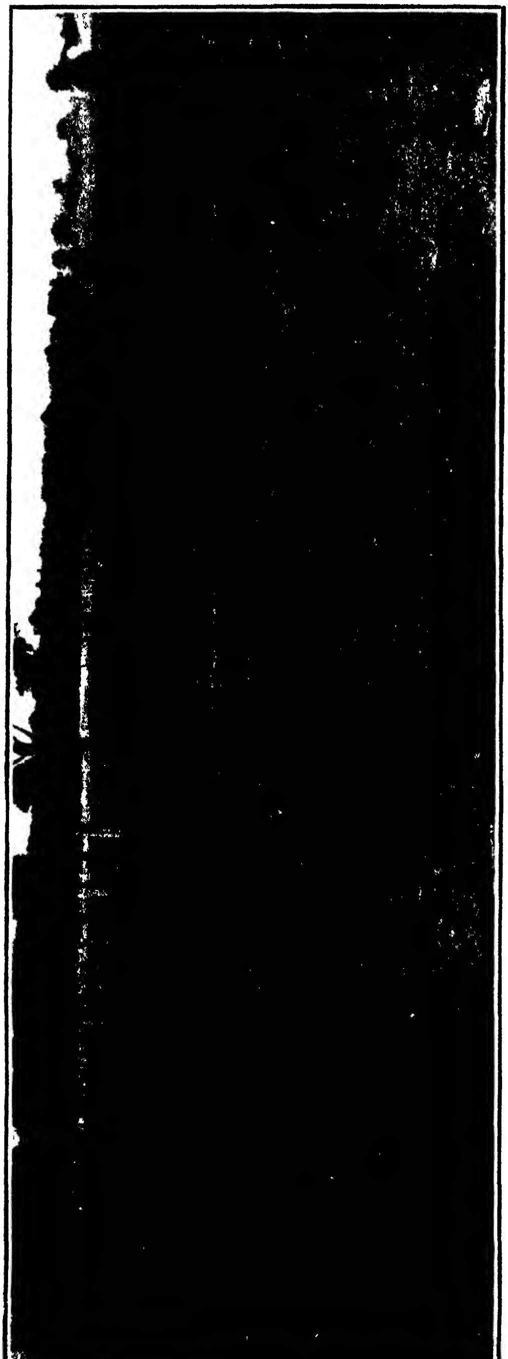
"Vuelta," one of the Department's High Testing Cows.

Milk yield 1911-12, 41 weeks, 7752 lbs.; butter fat test 1911-12, 5.2 composite minimum, 8.2 composite maximum; butter fat yield 1911-12, 485.1 lbs.; butter fat value 1911-12, £26 5s. 9d.; commercial butter 1911-12, 553 lbs.

these conditions of the Goldleaf and Birdseye calves may be considered fortunate. Three guineas additional is charged if the calves are kept till over twelve months old; but this has occurred in only one case, each season's drop having been disposed of as calves. Details of the bull calves available are advertised in the *Journal* as the drop proceeds, and those which are bespoken are reared for delivery at six months. If a calf does not rear well, a second choice is allowed, but so far no purchaser has had occasion to take advantage of this.

Reports from breeders who purchased the earlier calves show that upwards of 90 per cent. of the calves got by the Red Poll bulls, ex crossbred cows, or cows of other breeds, are hornless, and 75 per cent. are whole red in colour.

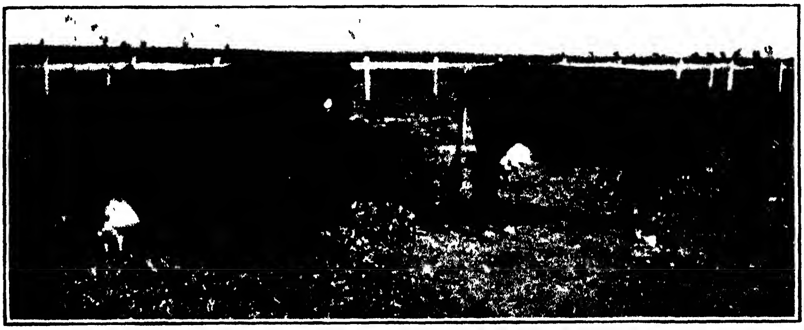
The characteristic feature of the breed, viz., hornlessness, is destined, in the opinion of the writer, to play an important part in the economics of dairying in Australia. With the gradual increase in the expensiveness of hired labour, the cost of stall feeding dairy cows is becoming



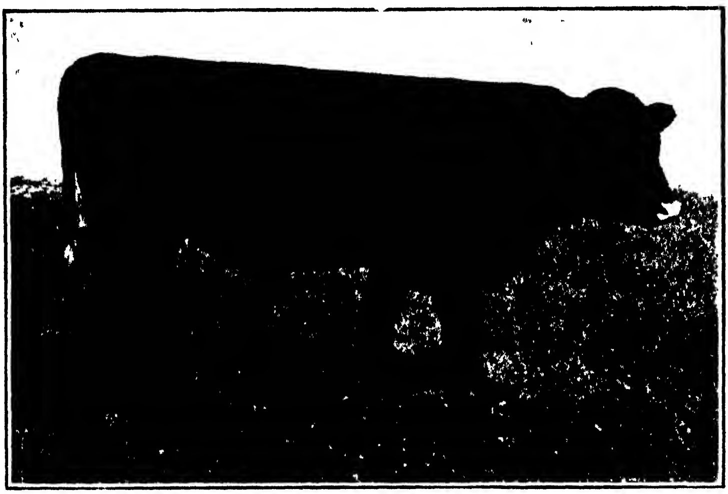
A Section of the Departmental Herd.

almost prohibitive, and yet hand feeding or artificial feeding in some form must be carried on if the butter yield is to be maintained or increased. For this country must adopt the practice of growing and conserving fodder in the spring for feeding in the autumn and winter if it is to continue to compete successfully in the butter export trade. The period of lactation of cows must be lengthened to increase profits to a degree commensurate with high land values and costly labour; winter dairying must be carried on to avoid the present baneful break in our supplies to the London market; and neither of these things can be done if dependence is placed on pasture alone and without hand feeding.

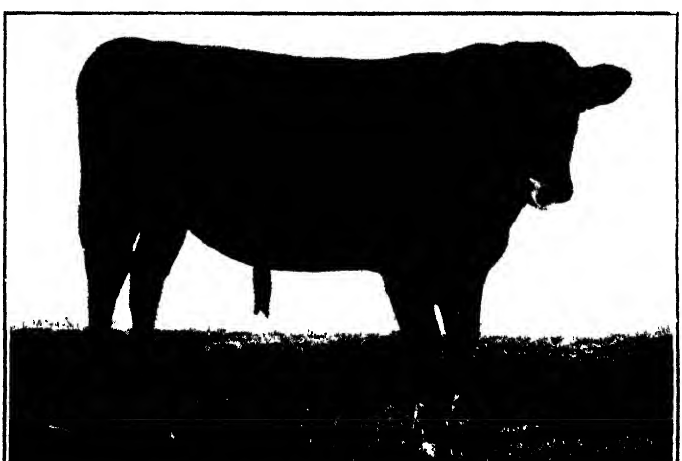
With horned cattle, for hand feeding to be successful, they must be stalled and fed separately. If dehorned, or hornless, they may be fed with half or less labour from troughs or racks in open sheds, or yards, or paddocks. When deprived of their horns, cattle cease the disastrous butting and ripping of one another which is so common a sight in cow-yards, and the damage done by the bully of the herd, if such exists, is negligible. On one of the large dairy farms along the Murray in South Australia a dehorned herd of 100



Showing evenness of type.



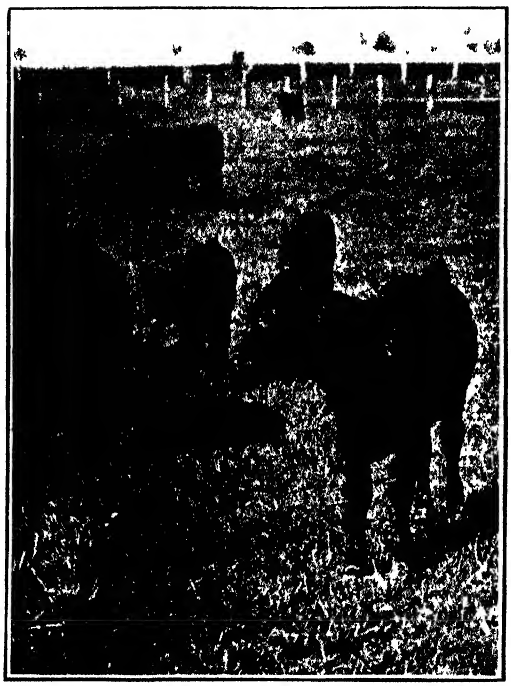
" Vuelta's " Son as a Yearling.



" Nicotine " as a Yearling.

milking cows is kept continuously on a paddock of 30 acres, being fed with green lucerne and lucerne hay deposited from a waggon over the fence into long lengths of troughs, out of which the fodder is eaten by the cows comfortably ranged up side by side.

Lest some dairymen, who sight the advantage of conserving labour in hand feeding in the way suggested above, may be led into trouble, it is necessary to mention that dehorning has been decided by the Courts of this State to be illegal. Consequently, if hornless cattle are wanted, it is necessary to breed them hornless, and it was with a view of giving a lead in this matter that the Department undertook the experiment of establishing a herd of polled milkers. The breed has been



Some of the Season's Drop.

developed as a milking herd in England for many years, Lord Rothschild's herd at Tring Park being notable as deep milkers. But in Australia they have hitherto been mainly known as a beef breed, reputed for their quick conditioning, and it was with some misgiving that the experiment was undertaken. So far the indications are that the milking function is inherent in the breed, and the records published during the last two years, as well as those set out in the tables following, appear to show that the cross may be introduced into ordinary dairy stock without any risk of a diminished milk yield. At any rate, results so far afford ample justification for the departure made by the Department and for its continuance.

YIELDS AND RETURNS OF THE GOVERNMENT HERD OF RED POLL DAIRY CATTLE.

Season 1910–11.

Cow	Days in Milk	Weeks in Milk	Milk in lbs	Tests	Butter Fat	Commercial Butter.	Values.		
					lbs	lbs	£	s	d.
Vuelta .. .	270	38½	556	7 0 7 8	405 14	461¼	17	10	10
Bullion . .	283	40½	773	4 2 5 0	356 71	406½	15	17	10
Connecticut .	283	40½	818	4 2 4 6	269 06	306¾	11	17	4
Virginia.	283	40½	636	3 8 4 6	254 75	290½	11	5	1¼
Carolina	283	40½	570	4 2–4 8	253 14	288½	11	3	4¼
Havana	283	40½	575	3 8–4 6	229·97	262¼	10	5	0¼
Cuba .	283	40½	526	4 2–4 8	231 89	264¼	10	5	11
Muria	283	40½	548	4 2–6 2	240 70	274¼	9	14	9¾
Kentucky	245	36½	531	4 0–4 6	225 98	257½	9	12	7
Cigarette	238	34	504	4 0–4 6	211 61	241¼	8	18	9
Beulah	135	19¼	397	4 2–4 9	200 44	228½	8	5	2
Pennsylvania	270	38½	461	4 0 -4 1	189 75	216¼	8	4	3¼
Average for 12	261	37¼	575 0	4·4	255 77	291½	11	1	9

Season 1911–12.

Cow	Days in Milk.	Weeks in Milk	Milk in lbs.	Tests	Butter Fat	Commercial Butter.	Values.		
					lbs.	lbs	£	s.	d
Vuelta	289	41¼	775	5 2–8 2	485 1	553	26	5	9
Connecticut	283	40½	678	4 6–6 4	364 0	485	19	11	10
Bullion	305	43½	694	4·8–6 2	344·0	392¼	18	10	7
Beulah	278	39¾	646	4·9 6·4	342 6	390½	15	3	6
Cuba	304	43½	701	4 4–8 4	337 8	385	18	10	4
Cigarette	291	41½	648	4 0–5 6	285 9	326	15	14	6
Sumatra	293	42	666	4 0–5 0	284 2	324	15	6	2
Kentucky	277	39½	669	4 0–4·8	277 7	316½	15	1	1
Muria .	286	41	580	4 5–7 0	275·7	314¼	14	14	10
Pennsylvania	318	45½	634	4 0 -5 2	271 9	310	14	13	10
Carolina	226	32¼	580	4 0 5 0	254 3	280	13	11	4
Virginia	277	39½	551	3 9–4 6	221 7	252¾	12	0	7
Havana	262	37½	535	3 8 4·5	215 3	245½	11	15	4
Average for 13	283	40½	635 5	4 7	304 6	346¼	16	4	7

Season 1912–13.

Cow	Days in Milk	Weeks in Milk.	Milk in lbs	Tests	Butter Fat	Commercial Butter.	Values		
					lbs.	lbs	£	s	d
Muria	256	36½	578	4 5–7 3	314 96	359	15	15	0
*†Goldleaf	273	39	643	4 1 -5 3	308 50	351½	15	8	6
Bullion	239	34	649	3 8 6 8	296 90	338½	14	16	10
Virginia	259	37	650	3·6–5 7	282 56	322	14	2	6
†Cigarette	273	39	681	3 9–4 8	278 56	317½	13	18	6
Connecticut	320	45¾	610	4 0- 7 6	277 85	316¾	13	17	10
‡Vuelta	263	37½	665	3 5–5 3	273 81	312	13	13	9
†Egypta	273	39	630	3 7–5 2	269 22	307	13	9	3
†Cuba .	251	36	628	3 9–5 4	269 11	306¼	13	9	1
†Kentucky	266	38	624	3 4–4 4	256 00	291¼	12	16	0
†Havana	258	37	606	3 5 5 5	252 95	288¼	12	12	11
*†Birdseye	273	39	435	3 9–8 0	250 34	285¼	12	10	4
Sumatra	230	33	567	3·7–5·5	238 37	271¾	11	18	4
*†India	268	38¼	523	4 1 6 2	238·16	271½	11	18	1
*Persica	252	36¼	419	4 6–7 7	218 69	249¼	10	18	8
†Pennsylvania	230	34¼	497	3 8 5 9	215 09	245¼	10	15	0
Europa . .	324	46¼	459	3 6 7 1	201·13	229¼	10	1	1
Carolina	274	39	445	3 6–6 5	198 30	226	9	18	3
*Turka ..	191	27¼	359	4 6–5 9	178 27	203¼	8	18	3
*Mexicana	210	30	383	4 0–5 1	171 58	195½	8	11	6
*Regalia	338	48¼	338	4 4–6 0	161 58	184¼	8	1	6
*Cabana	273	39	337	4 0–5 4	153 23	174½	7	13	3
*La Suelta	241	34½	266	4 3–8 2	134 23	153	6	14	3
Average for 23	262	37¼	521 8	4·5	236 49	269	1		5

* Heifers on first calf.
† Records under Government standard test conditions
‡ Suffered from eye accident for a considerable period.

CONCRETE ON FARMS.

(A) Concrete Silos.

By J. Wilson, Silo Builder.

The advantage derived from the construction of silos by using concrete bricks made from the material found on most farms, namely, gravel and sand, with the addition of a proportion of cement (six of sand to one of cement), is steadily being recognised. The silo so built is fireproof, white ant and mouse proof, as well as being durable. The proportion of cement used is so small that it is hardly noticeable in the matter of cost, only sixteen casks of cement are used to make

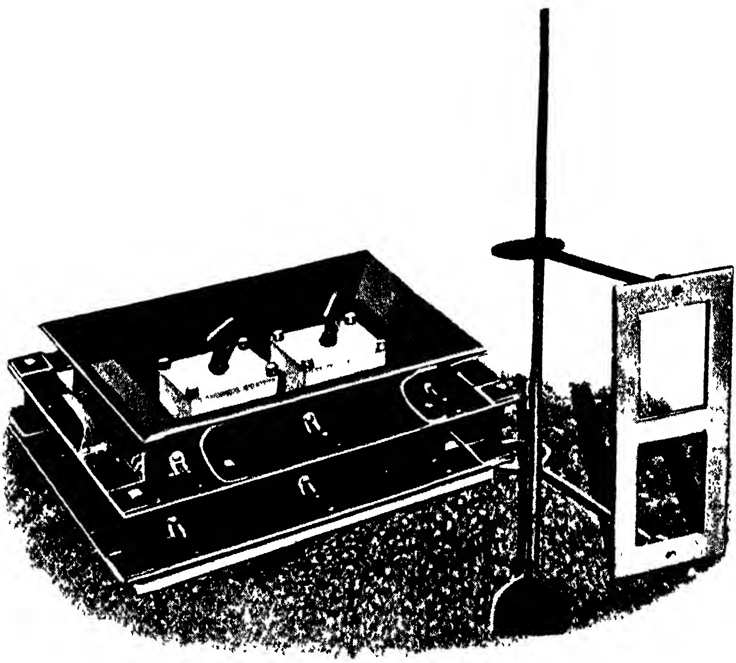


Fig. 1.—Brickmaking Machine.

the bricks and set them in a 70-ton silo. Farmers who elect to build silos or farm buildings generally for themselves with the aid of farm labour can now do so with a brickmaking machine and the use of average intelligence. The necessary material, sand and gravel, or sand, is usually to be found close at hand. The sand should be sharp, and washed clean, as both clay and loam are drawbacks, particularly the former. An up-to-date machine made entirely of steel can be had for a nominal sum. The machine makes a hollow brick 24 in. x 6 in. x $6\frac{1}{2}$ in., and is lifted from the brick, thus preventing any possibility of the block becoming cracked or strained. The weight of a single brick is about 30 lbs., and considerable care and thought

has been expended over the construction of the machine; its usefulness for silos or buildings is fully assured.

To build a 70-ton silo, 850 blocks of the size mentioned are required, and one man, with the assistance of a lad, can make them in a week, and the building should not occupy more than ten to twelve days to erect. The bricks must be properly cured before laying; this is accomplished by sprinkling them with water night and morning for a fortnight, so as to prevent them from drying too quickly. In building, the blocks are set in cement mortar of a mixture made of four parts of sand to one part cement in the same manner as ordinary bricks. It is advisable not to mix more mortar than can be used in half-an-hour, as set or hardened cement mortar is quite useless. To insure success, the initial set should not be disturbed.

Foundations.

Level a site for a diameter of 16 feet, fix a centre point by placing a 2-in. pipe firmly in the ground, so as to receive a 2-in. pole; from this centre attach a piece of quartering, 7 ft. 4 in. long, to act as a trammel which will describe a circle having a diameter of 14 ft. 8 in. inside measurement. Care should be taken to fix the pole plumb so as to obtain an accurate circle. Cut out a trench 6 inches deep and 12 inches wide, the bottom to be level. A double wall is laid in the trench for the first course, and then single walls to the top.

The blocks break joints at 12 inches in succeeding courses, which allow the hollows in the bricks to come over each other.

Reinforcing.

During the course of construction the walls should be reinforced by laying on the top of each course ordinary fencing wire (any old wire lying about the farm will answer the purpose), clipped together at joints, and built in with the blocks. Three rows of wire to each course for the first 4 feet, and for the remainder two rows of wire. The height of a 70-ton silo is 21 feet, and inside diameter 14 ft. 8 in., and requires 850 bricks, each 24 inches long, of this number 45 would be required to form the footing course. Port holes, or doors, are formed in the following manner:—The first or bottom door commences six courses from the ground, one brick being left out for four courses; there are three such doors to a silo, allowing six courses between each door, size of opening will be 2 ft. x 2 ft. Form the doors of galvanized iron, 24 gauge, cut 3 ft. x 2 ft. 6 in., and nailed to three strips of 3-in. x 1½-in. hardwood 2 feet long. Door frames are built of 6-in. x 1½-in. hardwood, and checked out 1½ inches to receive ledgers of doors.

The inside face should be bagged smoothly, so as to be free of mortar projections, and the joints of exterior struck smoothly with a trowel.

Build in on the top course of bricks eight bolts, each 10½ in. x ½ in. long, for bolting down the plates of the roof, four plates of 4 in. x 2 in. are used, and the purlins are propped up with 4 in.

x 2 in. studs, bolted to the plates at the bottom, and halved out 2 inches at the top, to receive purlins. Fix two braces 3 in. x 1½ in. from centre studs to ridge purlins; two purlins are used to form ridge. All timber used is of hardwood. Cover with corrugated iron, 9-ft. sheets, and fasten with spring head nails, nailing the iron every second corrugation. The concrete silo is one of the types erected for farmers, on terms, by the Department. Application forms for the construction can be obtained from the Department of Agriculture, Treasury Buildings, Melbourne, together with particulars of the general conditions under which the silo is erected. The cost of erecting a 70-ton concrete silo complete, with elevator, is £55, subject to slight variation on account of distance from Melbourne and cost of cement.

MATERIAL REQUIRED FOR A 70-TON CONCRETE SILO.

Hardwood, 4 in. x 2 in., six 18 feet, three 16 feet, purlins plates and studs
Hardwood, 6 in. x 1½ in. three 9 feet, door frames.
Hardwood, 3 in. x 1½ in., two 18 feet, braces for roof.
Galvanized corrugated iron, 26 gauge, 9 feet, eighteen sheets.
Galvanized plain iron, 24 gauge, 72 in. x 36 in., three sheets
Galvanized ridging, 26 gauge, 16 inches, 18 feet.
Spring head nails, 2½ inches, 3 lbs.
Wire nails, 3 inches, 5 lbs.
Cement, sixteen casks.
Sand, 16 cubic yards.
Bolts, nuts, and washers, eight 10½ in. x ½ in., two 6½ in. x ⅜ in., ten 4½ in. x ⅜ in.

MATERIAL FOR 30-FT. ELEVATOR.

White deal, 6 in. x ⅞ in., T. and G., nineteen 20 feet.
White deal, 6 in. x ½ in., T. and G., four 15 feet.
Oregon, 6 in. x 1½ in., one 8 feet.
Chain, 60 feet, 1 9-16 pitch, No. 45 link.
Thirty Oregon slats and attachments for No. 45 link.
One 8-inch diameter sprocket wheel, 16 teeth, 1 9-16 inches pitch.
One 8-inch diameter x 11¾-inch pulley.
Two adjustable bearings.
One 22 teeth, 10½-inch diameter, sprocket wheel for No. 52 link, 1½-inch pitch.
One 10 teeth 5-inch diameter sprocket wheel for No. 52 link, 1½-inch pitch.
14-ft. chain 1½-inch pitch, No. 52 link.
Eight 2½-inch x ½-inch bolts, nuts, and washers.
Eight ¾-inch washers.
Two sheets 72 in. x 36 in., galvanized plain iron, 24 gauge.
4 lbs. 2-inch, 2 lbs. 3-inch, wire nails.

(B) Concrete Fence Posts.

The manufacture of concrete fence posts is yet in its infancy, but such posts undoubtedly show superiority over the wooden ones. They are usually made 7 feet long, 5 in. x 5 in. at base, tapering to 5 in. x 3 in. at the top, with holes placed at suitable intervals for either plain or barbed wire. To these concrete posts timber can be bolted to carry gates and any class of fence. Plain wire, barbed wire, or wooden pickets can be readily attached.

The machine for moulding the posts is constructed of steel throughout, with collapsible sides and ends, so that a man, with the

assistance of a lad, can make 100 posts per day of eight hours' labour. Reinforcing is recommended with some form of metal (old fencing wire, either plain or barbed, or hoop iron will answer the purpose). The superiority of such posts over wooden ones is self-evident. They

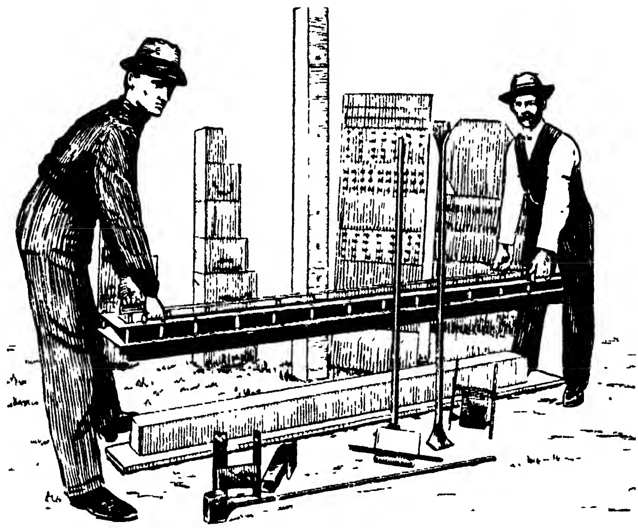


Fig. 2.—Making Fence Posts.

are fireproof and rot-proof; weeds, leaves, and rubbish which usually accumulate around the base of fence posts may be burnt without the slightest injury to the post. It is practically everlasting, and in many localities prove equally as cheap as a wooden post, since it must be remembered that the first cost of a wood post is not the only one; a

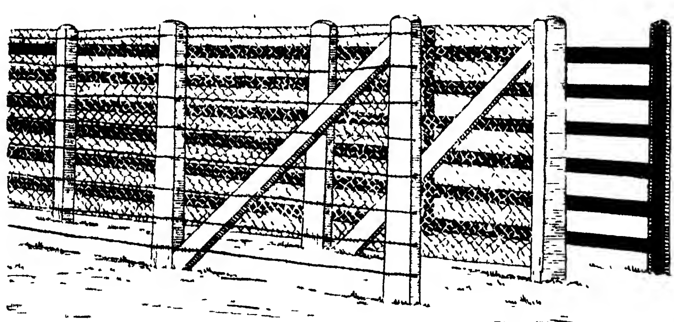


Fig. 3.—Different Kinds of Concrete Fences.

wood post may rot away or be burnt, and the cost of maintenance must be considered.

Posts of any size can be made in the moulding machine by blocking off at either end, and the fastening holes for each post can be regulated according to requirements.

THE VALLEY OF THE UPPER MURRAY.

By Alfred J. Ewart, D.Sc., Ph.D., Government Botanist of Victoria, and Professor of Botany and Plant Physiology in the Melbourne University.

This district exhibits several interesting features both from a botanical and an agricultural point of view. The particular portion referred to may be said to extend from Bethanga to Bringinbrong and Towong, where the head of the Murray divides into the Swamp River and the Indi River. Allowing for the windings of the river, the length of this portion of the valley is probably over 100 miles, and the width of the valley varies from 1 to 3 miles. All the surrounding country is of an old well-sculptured type. Opening into the main valley, particularly on the upper part, are lateral valleys of equal or even greater breadth, extending back in some cases for 10 or 20 miles, such as the valleys at Burrowye, Walwa, Corryong, and Cudgewa. The broad flood plains forming the floors of these valleys consist of rich alluvial soil, a large part of which is sufficiently raised above the river level to be liable only to occasional flooding, and is hence admirably adapted for intense agriculture. Owing to the difficulty of communication, however, it is at present used almost solely for grazing, and nothing was more striking than to notice the almost entire absence of any cultivation, and the almost complete absence of any storage of fodder. This is the more remarkable, since last * summer famine prices were being paid for fodder in order to keep the stock alive. In some parts the herbage was so tall and luxuriant as to make it difficult to understand why none is cut and dried as English hay. In addition, many of the pasture plants common throughout these fertile valleys are not of the very first rank. For instance, white clover is comparatively scarce, red clover and lucerne practically absent, and none of the very best pasture grasses can be said to be as abundant as they might be. Perhaps, the commonest of the pasture plants are, on the whole, burr-medick, barley grass, mouse-ear chickweed, festuca bromoides, cape weed, flatweed, and—thistles. In some parts subterranean clover occurs, and a few native fodder plants. Kangaroo grass is scarce, but wallaby grass is fairly common. Perhaps one of the most striking features on these flats is the way in which the removal of the native redgum and the presence of stock have driven out the native flora, and caused it to be replaced by introduced pasture plants and weeds. A few of the native plants, however, appear to hold their own, such as Craspedia ("Billy Buttons"), Brunonia ("Blue Pincushion"), and the two native Acaenas, "Sheep's Burr" and "Bidgee Widgee," while in wet places the Bladderwort (*Utricularia*), and on the drier foothills the "Bluebell" (*Wahlenbergia*), *Daucus brachiatus*, the austral carrot, and a few of the smaller native compositæ easily hold their own.

This is one of the districts in which great stress is laid upon the fodder value of thistles in time of drought. The Shore Thistle, *Carduus pycnocephalus*, is perhaps the commonest plant in the whole district, and it grows abundantly not only on the river flats but also

* 1911.

up the hillsides to elevations of over 1,000 feet. Several acres of this thistle in different parts were closely examined where horses and cattle were grazing, but without finding any signs of a single thistle plant having been eaten. Occasional plants were trampled down, but not otherwise touched; and, in many cases where the animals appeared to be actually eating thistles, close examination showed that they were picking out the grass from around them and leaving the thistles untouched. Exactly the same was noted where sheep were grazing in a pasture containing thistles, but with plenty of rich grass and clover. Where the grass had been cropped short the sheep began to eat the heads of the thistles; but, in spite of the fact that the previous year had been a so-called drought season, it was possible to find plenty of dead thistle stems with shrivelled leaves attached on grazed pasture land. Apparently, therefore, stock provided with high-grade pasture plants do not eat thistles, except by accident; or in the same way that a man may take small quantities of non-nutritious condiments with his food. Sheep appear to attack shore thistle before cattle and horses do, but they can only be said to turn their attention properly to it when compelled by the scarcity of suitable fodder plants. If the place of the thistles was taken by herbage which could be converted into dry fodder, the gain in carrying capacity would be very great, and the " drought " danger—or, rather, starvation danger—would be correspondingly decreased.

The " Variegated Thistle," *Carduus Marianus*, is fairly abundant both along the roadsides and along the river flats. Its leaves appear to be more readily eaten by stock than those of the shore thistle, and it is perhaps the nearest approach to a fodder plant of any thistle. The richness of the soil is well shown by the fact that it may attain a height of as much as 10 feet, its thick woody stem forming a litter of trash on the ground after flowering. The area of ground occupied by this plant would probably have some 20 or 40 times the carrying capacity if occupied by, say, lucerne, under irrigation. Occasional plants of the Spear Thistle, *Carduus lanceolatus* were found, but this thistle—which is the most obnoxious of the three mentioned—is fortunately not very abundant, and the land-owners do not seem to encourage its spread.

In connexion with the claim so frequently made as to the fodder value of thistles, one fact is worthy of notice. It can frequently be seen in the neighbourhood of rabbit-warrens that every good pasture plant has been eaten out, and only a few obnoxious weeds left. In some cases the plants so left consist entirely of thistles, such as the shore thistle, spear thistle, star thistle, &c. It is certainly curious that rabbits, which are good judges of fodder, should leave them severely alone so long as they have anything else to eat. Plants such as the shore, variegated, and spear thistles may be, in a metaphorical sense, regarded as consisting of small portions of inferior fodder, protected by a natural investment of barbed wire. No farmer would knowingly feed his stock upon inferior chaff mixed with chopped barbed wire, and yet to some extent a diet of thistles corresponds to this. Of course, all plants popularly known as thistles are not alike, and while no one would claim the star and saffron thistles as fodder plants, many

persistently uphold the fodder value of the spear, shore, and variegated thistles. The so-called Sow Thistle, *Sonchus oleraceus*, is strictly speaking not a thistle at all, and is in any case not a thistle under the Act. Both rabbits and stock eat this plant freely, so that in pastures it is often eaten out, and is rarely able to become abundant.

There is one part of all thistles which has a certain food value, namely, the seeds, which strictly speaking are one-seeded fruits. These contain a good deal of nourishment, relatively almost as much in fact as the sunflower seeds, but their small size and the difficulty of collecting them prevents them having any economic value. They afford food, however, for many seed-eating birds; and it is generally considered that in New Zealand sparrows, by eating the seed of the variegated thistle, played an important part in keeping down this plant in districts where it had established itself. At the same time, by dropping occasional undigested seed, they may have helped in carrying it to districts where it did not previously grow. In Victoria, so far as is known hitherto, birds do not seem to have played any pronounced part in either keeping down thistles or in encouraging their spread. At Walwa, on the Upper Murray, starlings have recently appeared, and seem to be increasing in numbers rapidly. Although primarily insect and fruit eaters, these birds, like sparrows, seem ready to turn their attention to anything capable of being swallowed, and it will be interesting to notice in the future whether they exercise any influence upon thistles or other weeds of the district.

Among the commoner weeds along the Upper Murray a few are worthy of special mention. The Flatweed, *Hypochaeris radicata,* is very common, but is hardly to be classed as a serious weed. Several species of dock are, however, abundant, and some of the river flats are completely overrun with sorrel. Both of these are serious weeds, and can only be eradicated when fully established by thorough and cleanly cultivation. In the case of the docks, cutting before flowering prevents further spread, but has no perceptible effect upon the individual plants when once established. Cape weed is fairly abundant, and appears to have spread up the valley along the roadsides and thence run into the pastures. Paterson's Curse, *Echium violaceum*, is abundant in many parts below Walwa, and has also appeared higher up the river, where there seems to be a danger of it spreading. The Shepherd's Purse, *Capsella Bursa-pastoris,* is fairly common, but not sufficiently so as to be troublesome. The same applies to the common mallow which occurs occasionally near houses, and to the Hedge Mustard, *Sisymbrium officinale,* of which occasional plants or clusters of plants are to be seen. The bracken fern occurs in various parts, and, although it is not abundant, on a large amount of the land from which the timber has been cleared it will be very apt to spread and become a pest in future years if not kept down. The little purple tipped flowers of Bartsia showed almost everywhere among the pastures, and as this plant is parasitic on the roots of the grass, causing it to weaken or die out for a time, it very seriously deteriorates the carrying capacity of pastures in which it is abundant. It can only be destroyed by bringing the pasture under cultivation for a

time. A curious point in regard to distribution which was noted on several occasions was the occurrence of nettles on the tops of the cleared hills, but not on their sides or in the valleys below; and this in spite of the fact that they had evidently suffered somewhat from exposure to recent cold winds. The shore thistle also was often more abundant and taller on the tops of cleared hills than on the sides. This may possibly be partly due to the fact that sheep and other animals usually prefer to feed on the sheltered side of a hill, rather than on the exposed top.

One weed that might have been expected to be abundant, but which has evidently been kept down very successfully, is the Sweet Briar, *Rosa rubiginosa,* and the land-owners seem for the most part aware of the danger of allowing the plant to spread. It is scarce or absent on the pastures, and only an occasional clump occurs here and there in some of the gullies. All such plants should, of course, be destroyed, since the seed are continually carried by birds on to the pastures. At Jingellic, on the New South Wales side of the river, the sweet briar is very abundant, and is apparently spreading freely. This is, of course, bound to be a constant source of infection to the pastures on the Victorian side of the river.

Modiola multifida, "The Red-flowered Creeping Mallow," which is practically a useless pasture weed, appears to be spreading and increasing along the pastures on the Upper Murray, above Thologolong. Very common and conspicuous in the pastures and along the roadsides were the tall spikes of the yellow-flowered *Verbascum Blattaria,* "The Spurious Mullein," which is one of the oldest of our naturalized aliens, while *Stachys arvensis,* "The Wound-wart or Stagger Weed," which is also an early introduction, is fairly common in many parts. Two recently introduced weeds appear now to be fairly common. Thus *Tunica prolifica,* "Productive Carnation," first recorded in 1903, grows in several places, and especially at Mount Alfred, near Walwa; while *Linaria Pelisseriana,* "Pelisser's Toad Flax," grows in fair abundance at Guy's Forest, and at various localities along the Upper Murray, Corryong, and Cudgewa valleys. Since some species of Linaria have recently been shown to be capable of exercising a poisoning action on stock, the spread of this plant, in spite of its delicate spurred blue flowers and elegant appearance, is to be looked on with suspicion.

Along the whole valley, in spite of a careful search, and excluding some of the more rocky parts, which were difficult of access to stock, I was not able to find a single seedling of "Currajong," *Brachychiton populneus;* and if any seedling redgums occurred on the river flats grazed by stock, they were exceedingly few in numbers, and the majority of the redgums had apparently died of old age without any others taking their place. Since the currajong forms a valuable fodder reserve in time of scarcity, self-interest alone should show the desirability of preserving this valuable and interesting tree, which is rapidly in process of extinction. The tree grows readily from seed, and all that is necessary to re-establish it is to fence off small areas where a few trees are growing and scatter the seed over the ground.

"The Weeping Willow," *Salix Babylonica,* is planted in many places, particularly on the banks of the river and smaller streams. The leaves and young branches of this tree are eaten readily by stock, so that it acts as a fodder reserve, although only a poor one in comparison with a good hayrick or lucerne stack. The value of this tree in preventing the erosion of the banks is very great. Throughout the whole district numerous instances occur where the timber has been cleared away from the steep rocky hillsides, with the result that each rainfall rushes rapidly off the surface, carrying down the soil covering, and the sudden rush of water in the creeks causes them to eat steadily upwards into the hillside. The latter can be stopped to some extent by planting willows along their banks, but of course the planting must be done before the whole of the soil is washed away.

One point worthy of mention, though hardly a botanical matter, is in regard to the tin mine recently established at Walwa, and apparently about to rapidly increase in size. As at present arranged, the tailings from the stamps run on to the flood plain of the Murray and are reached by the water when the river is in flood. The tailings appear to set fairly hard in dry weather, but in wet weather would be carried away with the river. Since there is an intention of putting a weir across the river lower down, it would be a serious matter if the tailings flowed down the river in quantities sufficient to fill up the weir, or to decrease its capacity soon after it was formed. It would be a simple matter as things are at present to move the stamps further inland, and to allow the tailings to be deposited behind screens of brushwood, so as to avoid any danger to the river.

The general impressions one receives from the district as a whole, apart from the variety and beauty of the scenery and the frequency of running streams of water, are the extreme fertility of the plains forming the valley system, and the comparatively small agricultural use to which this mine of potential wealth has as yet been put. With better communication the plough will come more frequently into use, and with the plough a more numerous population and the higher forms of agriculture should develop.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

SPRAYING.

The peach aphis will now have made its appearance in orchards which were not sprayed with the red oil emulsion in the winter. The tobacco solution will now be required, and this may be sprayed on as strongly as the grower wishes. If possible, the spraying should be repeated quickly after the first operation, so as to kill any aphides previously protected by the others, or any that may have only been weakened by the first operation.

The time has also arrived when spraying is needful for the prevention of all fungus diseases, such as shothole or scab, black spot, leaf rust, leaf curl, &c. In the case of these pests, "prevention is better than cure" is the invariable rule; and to delay beyond the correct period the application of the necessary sprays is to court disaster. For black spot of apple and pear, the spraying should be performed as soon as the earliest flowers are opening. For shothole and scab, the time to spray is before the flower petals expand; and the spraying may be repeated, if necessary, after the fruit has set.

For rust and leaf curl, the spray should be applied before any sign of trouble appears on the foliage; thus, if the fungus were present during the previous season, it will be necessary to spray early to combat it successfully.

The basis of all successful fungicides is sulphate of copper or bluestone. Bordeaux mixture, a mixture of bluestone, lime, and water, known as the 6—4—40 formula, is used; the materials and quantities being 6 lbs. bluestone, 4 lbs. lime, and 40 gallons of water.

Another spray, and in some locations equally as successful in its results as the Bordeaux mixture, is the copper-soda spray, the proportions being 6 lbs. of bluestone, 8 lbs. washing soda, and 50 gallons of water. In each case, the materials should be separately dissolved, and then evenly and simultaneously mixed in a third vessel.

It is very important that the lime should be thoroughly fresh and quick, otherwise the spray mixture will give very inferior results. A second necessary point is that the copper sprays should be used as soon as they are made. Where any difficulties are experienced, or where the grower does not wish to make his own spray, there are quite a number of ready-made Bordeaux pastes and Bordeaux mixtures already on the market, which can be used with satisfactory results. In fact, the use of these has become fairly general, and it is not now the practice for growers to make their own sprays.

General.

Grafting should be carried out at once, whether for young trees or for re-working old ones. In connexion with this work, it is wise to cut back the trees some time before the operation is performed. Then, when the grafting is carried out, the dead ends may be cut off, and the grafts inserted in the new cuts. If the ground is at all warm, all varieties of citrus trees may be planted. The soil requires to be very sweet and well drained

Cultivation.

That the season is an extremely early one has been shown right throughout the State. At the Burnley Gardens, the Chinese Sand pear, which is generally in full bloom about the middle of August, was in full bloom in the middle of July. Other early-blooming fruit trees have also come into flower much earlier than previously. It is, therefore, most important that ploughing should be completed as early as possible. In the past, it has very frequently happened that, owing to delaying the ploughing, the orchard and the fruit crop have both suffered very considerably. It is absolutely necessary to cultivate the surface early, to take advantage of the moist surface and consequent easy ploughing, and also to conserve as large an amount of moisture in the soil as possible. The longer the ploughing is delayed, the less amount of moisture is retained in the soil for summer use. Deferred ploughing certainly means dry soil, enfeebled trees, and diminished results. Early ploughing gives exactly opposite results; the earlier the ploughing, the more soil-water is conserved.

When the ploughing is completed, the clods should be crushed, and the land harrowed, so that a fine earth mulch may be obtained. The orchard surface should be kept as level as possible, and no irregular ridging or furrows should be allowed.

All cover crops planted to supply humus to the soil should now be ploughed in. If the plants are of a leguminous nature, the best time to plough these in is when they are in full flower. If the growth has been at all excessive or rank, the crop may be rolled before ploughing, or it may be mowed or cut with a mowing machine. Every care should be taken that the plants will be well distributed throughout the soil, and large quantities in a mass should not be ploughed under. Artificial and stable manures may also be given to the trees at this time. These should be applied before ploughing.

Vegetable Garden.

The vegetable plots should be cleaned from all weeds, having the light weeds dug in, and the stronger ones pulled out and rotted in the compost heap. The surface should be worked up to a very fine tilth after digging; it must be kept constantly loose with the hoe to keep the soil cool; and prior to digging it will be advantageous to give a top dressing of lime.

If the weather be dry or windy, all newly-planted plants should be frequently watered. In transplanting seedlings, it is a help to dip the whole plant in water before planting.

Any seedlings that are ready may be planted out; tomato plants may be planted out under shelter until the frosts are over. At the end of the month a sowing of French bean seeds may be made. Seeds of peas, broad beans, beet, cabbage, Kohl rabi, radish, turnip, cauliflower, lettuce, carrot, parsnip, &c., may be sown in the open. Seeds of melons, cucumbers, pumpkins, marrows, and similar plants may be planted in frames for transplanting after the frosts have gone.

Flower Garden.

After digging, the surface must be kept constantly stirred with the hoe, so as to have it loose and friable for cooling and for moisture-conserving purposes. All weeds must be kept down, as they are robbers of plant food and moisture at this season of the year. Shrubs of all kinds may still be planted out, and these should be well watered after planting

Rose and other aphides must be watched for, and treated according to instructions given in last month's notes. Rose scale should be sprayed with lime-sulphur wash, or with kerosene emulsion. This pest will soon disappear if the bushes are kept open to admit the air and the sunlight freely. Rose mildew will now be appearing, and the plants, as well as the soil, should be sprinkled with liberal dustings of sulphur. Sulphide of potassium is also a good specific for this fungus trouble, using it at the rate of 1 ounce to 3 gallons of water.

Cannas, early chrysanthemums, and early dahlia tubers may be planted out, as well as all kinds of herbaceous plants, such as delphiniums, perennial phlox, asters, &c. The clumps of these should be well divided, and in planting they should be fed with a liberal quantity of stable manure. Beds should be prepared and well dug over for exhibition chrysanthemums and dahlias.

Wattles of all kinds may be planted out, and many of these are suitable for garden work. For trees, *Acacia Baileyana* (Cootamundra), *A. saligna* (West Australian willow wattle), *A spectabilis* (weeping), *A. verniciflua, A. prominens, A. leprosa, A. longifolia, A. cultriformis, A. elata, A. decurrens,* variety *normalis, A. linifolia, A. iteaphylla, A. Maidenii, and A. retinodes* are all useful. While as shrubs, the following may be grown:—*A. discolor, A. longifolia,* variety *sophorae, A. suaveolens, A. Farnesiana, A. myrtifolia, A. acinacea, A. Mitchelli,* and *A. podylarifolia.*

Acacias may be readily pruned, the work being done after flowering; and if this work be commenced when the plants are fairly young, they may be trained into beautiful and shapely bushes and trees.

It is also a good time to sow the seed. The outer covering of Acacia seeds is very hard, and the growing root is not able of its own accord to penetrate it. The seed must, therefore, be immersed for a few moments in boiling water, and allowed to soak for at least twelve hours. After this, they may be planted direct into the garden or into pots for subsequent transplanting.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed	Name of Owner	Eggs laid during Competition: April 15 to July 14	July 15 to Aug 14	Total to date—4 months	Position in Competition.
23	White Leghorns	J H Gill ..	381	152	533	1
61	,,	Jno. Campbell	350	131	481	2
65	,,	E A. Lawson	361	119	480	3
48	,,	Thirkell and Smith	342	130	472	4
6	,,	J S Spotswood	358	111	469	5
11	,,	C J Beatty	333	132	465	6
8	,,	E. H Bridge	334	127	461	7
68	,,	Jones and Curtis	313	125	438	8
16	Black Orpingtons	D Fisher	306	130	436	9
31	White Leghorns	W G Swift	309	127	436	
46	Black Orpingtons	T. W. Coto	325	110	435	11
10	White Leghorns	T A Pettigrove	302	132	434	12
21	,,	A. Ross	322	98	420	13
35	,,	Moritz Bros.	290	127	417	14
34	,,	J E Bradley	301	114	415	15
50	,,	A H Mould	303	111	414	16
49	,,	M H Nove	271	128	399	17
66	,,	W Featherstone	283	110	393	18
37	,,	C H. Busst	274	117	391	19
7	,,	H McKenzie	275	114	389	20
47	,,	W McLister	269	106	375	21
26	,,	B Rolls	244	130	374	22
40	,,	Geo Edwards	272	100	372	23
32	,,	H Hanbury	252	118	370	24
43	,,	Morgan and Watson	254	113	367	25
20	,,	C. B Bertelsmeier	246	119	365	26
2	,,	R W Pope	261	95	356	27
41	,,	Percy Walker	245	111	356	
63	,,	A. Sellers ..	248	107	355	29
39	,,	W Purvis	248	106	354	30
13	Black Orpingtons	T S Dallimore	233	118	351	31
58	White Leghorns	Stranks Bros.	235	114	349	32
5	,,	G W. Robbins	213	132	345	33
67	,,	C Hepburn	237	107	344	34
24	,,	Redfern Poultry Farm	230	114	344	
38	,,	M A. Monk	241	101	342	36
14	,,	F Hannaford	258	80	338	37
25	Black Orpingtons	King and Watson	240	97	337	38
45	White Leghorns	D Gouddie	235	98	333	39
59	S.C White Leghorns	Cowan Bros	204	114	318	40
27	White Leghorns	J. Sinclair ..	225	87	312	41
3	,,	S Buscumb	212	99	311	42
18	,,	B Rowlinson	227	84	311	
55	,,	P H Killeen	191	114	305	44
52	,,	W. G. Osborne	183	117	300	45
62	,,	G A. Gent	177	108	285	46
22	,,	B. Mitchell	201	84	285	
42	,,	A. Stringer	148	127	275	48
33	,,	South Yan Yean Poultry Farm	151	122	273	49
17	R C Brown Leghorns	S P. Giles ..	164	96	260	50
44	White Leghorns	W. A. Rennie	152	108	260	
53	Black Orpingtons	A. Greenhalgh	182	76	258	52
57	White Leghorns	Gleadell Bros	165	91	256	53
56	,,	Schaefer Bros.	142	112	254	54
12	,,	A H. Padman	156	92	248	55
19	,,	W. Dunlop	154	89	243	56
51	Black Spanish	W. H Steer	121	122	243	
36	White Leghorns	A. J Jones..	118	119	237	58
28	,,	E Waldon	182	54	236	59
54	,,	Jas. McAllan	99	133	232	60
64	Golden Wyandottes	C L. Sharman	97	94	191	61
29	White Leghorns	S Brundrett	89	100	189	62
15	,,	J Shaw ..	109	80	189	
30	Black Orpingtons	Jas. Ogden	94	83	177	64
60	Black Spanish	Watson and Rushworth	59	96	155	65
4	White Leghorns	Jas Brigden	57	94	151	66
9	,,	Sylvania Stud Farm.	78	54	132	67
		Total ..	15,131	7,260	22,391	

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

MONTHLY REPORT ENDING 14TH AUGUST.

The past month concluded the winter test, and the output of eggs has been very satisfactory. For the first four months, 22,491 eggs have been laid by 402 birds, an increase of 1,299 eggs above that of the previous competition of 414 birds.

The weather for the month under review has been mild compared with last year, the temperature on only three occasions being 30 degrees, or thereabouts. Extremely cold and strong north winds have been experienced for days in succession, from which the birds took shelter very much.

The rainfall has been low, only 82 points being recorded at the pens for the month. Last year 225 points of rain fell during the same period.

The winners of the Winter Test (Gill, pen 23) have established a record for the Commonwealth by laying 533 eggs in four months, which is a splendid performance, and 53 eggs above the winners of last year's winter test. The second prize winner's (Campbell, pen 61) total was 481 eggs, one above Lawson's (pen 65).

The feeding in the morning was similar to that of the former month, but a slight increase of maize and pollard, when the cold north winds were experienced. At night, the ration consisted of wheat and cracked maize in equal parts, varied, in mild weather, by an increased proportion of wheat. The green food consisted of grass, thistles, &c., with an occasional supply of green lucerne.

The general health of the birds still continues excellent, all looking bright and vigorous.

REMINDERS FOR OCTOBER.

LIVE STOCK.

HORSES.—Continue to feed stabled horses well; add a ration of greenstuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses Feed old and badly-conditioned horses liberally. If too fat, mares in foal should be put on poorer pasture.

CATTLE.—Except on rare occasions, rugs may now be used on cows at night only. Continue giving hay or straw. Be prepared for milk fever. Read article in *Year-Book of Agriculture*, 1905, page 314. Give calves a warm dry shed and a good grass run. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Give half a cup of limewater in the milk to each calf, also place oats or lucerne hay in a trough so that they can eat at will.

PIGS.—Supply plenty of bedding in warm well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run.

SHEEP.—Avoid excessive dust in yarding sheep for shearing. Well bred fleeces free from dust and burr should be skirted carefully, the better the class of wool the greater the need. Fleeces that are dry and earthy on the backs need only stains removing, there is no advantage in removing burr on

these. It is better management to have ample table room, and extra men skirting carefully, than to hurriedly tear off unnecessary wool and then employ men at the piece table to sort what is known as "broken fleece" or "first pieces." All stains must come off fleeces, and weather stains from bellies. With crossbreds, separate all coarse fleeces from the finer sorts; and, with merinoes, the yellow and mushy ones from the shafty and bright. Skirt off any rough thighs from crossbred fleeces and keep separate. Press in neat bales; avoid "sewdowns." Brand neatly. If any likelihood of lambs not going for export before dry feed comes, shear at once.

Poultry.—The bulk of incubation should cease this month—late chickens are not profitable. Devote attention to the chickens already hatched; do not overcrowd. Feed with dry mash. Also add plenty of green food to ration, ordinary feeding to be 2 parts pollard, 1 part bran, a little dry bonemeal. Give a little three or four times a day, according to age. Feed crushed wheat or hulled oats at night. Avoid whole oats. Grit or coarse sand should be available at all times. Variety of food is important to growing chicks; insect life aids growth. Remove brooders to new ground as often as possible; tainted ground will retard development.

CULTIVATION.

Farm.—Plant main crops of potatoes in early districts and prepare land for main crop in late districts. Fallow and work early fallow. Sow maize and millets where frosts are not late, also mangolds, beet, carrots, and turnips. Sow tobacco beds and keep covered with straw or hessian.

Orchard.—Ploughing and cultivating to be continued, bringing surface to a good tilth, and suppressing all weeds. Spray with nicotine solution for peach aphis, with Bordeaux mixture for black spot of apple and pear, and with arsenate of lead for codlin moth in early districts.

Vegetable Garden.—Sow seeds of carrot, turnip, parsnip, cabbage, peas, French beans, tomato, celery, radish, marrow, and pumpkins. Plant out seedlings from former sowings. Keep the surface well pulverized.

Flower Garden.—Keep the weeds down and the soil open by continued hoeing. Plant out delphiniums, chrysanthemums, salvia, early dahlias, &c. Prepare ground for digging and manuring for autumn dahlias. Plant gladioli tubers and seeds of tender annuals. Spray roses for aphis and mildew.

Vineyard.—This is the best month for field grafting. If stocks bleed too copiously, cut off 24 hours before grafting. Field grafts *must* be staked, to avoid subsequent straining by wind and to insure straight stem for future vine. Stakes are also necessary for grafting rootlings for same reasons. Temporary stakes 3 feet long will suffice. Keep a sharp look out for cut worms. (See *Journal* for July, 1911, and also current issue.) Disbud and tie up all vines, giving special care to young plantations. Beware of spring frosts. (See *Journal* for September, 1910.)

Conclude spring cultivation (second ploughing or scarifying and digging or hoeing round vines). Weeds must be mastered and whole surface got into good tilth. Sulphur vines when shoots 4 to 6 inches long.

Cellar.—Taste all young wines; beware of dangerous symptoms in unfortified fruity wines, which may need treatment. Fill up regularly all unfortified wines.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 10. 10th October, 1913.

BEE-KEEPING IN VICTORIA.

(*Continued from page 548.*)

By F. R. Beuhne, Bee Expert.

XVI. TRANSFERRING BEES.

Owners of bees in box hives who wish to adopt the more profitable frame hive, or upon whom it has become obligatory to do so, can transfer their bees to frames by whichever one of the three methods described below best suits their circumstances. It may here be pointed out that the adoption of frame hives does not necessarily involve the purchase of expensive hives, honey extractor, and other appliances. Bees may be kept in home-made frame hives, and the honey taken by cutting out of the frames those combs which contain no brood and returning the frames to the hives to be refilled with comb by the bees. A strip of comb 1 inch wide should be left along the top bar of the frame; if this is cut to a V edge, very little honey will be left in the frame, and the necessity for putting a fresh strip of comb foundation into the frame is avoided, while yet straight comb building is insured.

Under the *Bees Act* 1910, the Governor in Council may proclaim districts in which bees may not be kept in other than prescribed hives. By a regulation under the Act (*vide Victorian Government Gazette* of 7th May, 1913), "Prescribed hive" shall mean any hive, the combs of which are in frames and capable of easy removal for the purpose of inspection. In a proclamation of the same date certain districts are enumerated in which the transferring of all box hive bees to prescribed hives becomes obligatory.*

* The districts mentioned in the Proclamation are the Boroughs of Ararat, Clunes, Hamilton, Horsham, Port Fairy, Portland, Sale, Maryborough, Stawell, Talbot and the Shires of Arapiles, Ararat, Avoca, Avon, Bairnsdale, Belfast, Dundas, McIvor, Maffra, Minhamite, Mount Rouse, Portland, Stawell, Strathfieldsaye, Talbot, Wannon, and Wimmera.

Although the Proclamation has effect from 1st May, 1913, all owners of bees are afforded opportunity to arrange for the transfer during the present swarming season, and the section of the Act which prescribes a penalty not exceeding £20 for failure to comply with the provisions of the Act will not be enforced until every owner has had time to conform thereto.

In order to effect the change with as little inconvenience as possible, hives with frames having starters (narrow strips) or full sheets of comb foundation fastened to the centre line of the top bars, should be in readiness so that all swarms which issue may be hived in such.

Transferring at Swarming Time.

When a swarm has settled (or clustered), it should be hived in an ordinary empty box, and, as soon as the bees are in, carried to the spot which the frame hive is to occupy.

Towards evening, when the bees are not likely to rise in the air again, the frame hive is placed in position, a bag or cloth spread out in front of the hive entrance in such a way as to provide an easy passage-way into the hive, and the swarm shaken or dumped out of the box on to the cloth. If the bees are slow in entering the frame hive or a considerable number remain outside, they may be gently driven in by blowing a little smoke on them; none, however, should be blown into the hive.

What to do with the box hive from which the swarm came will depend upon whether an increase in the number of hives is desired or not. If no increase is wanted, the bees remaining in the old box may, after turning it open side upwards, be drummed up into an empty box placed on top (as in robbing box hives), and the bees thrown down in front of the frame hive containing the swarm.

The contents of the box hive may now be disposed of in the way usual with box hives. The combs will contain a considerable amount of brood (much more than when box hives are robbed at the usual time), and the many thousands of young bees, which would in the ordinary course have hatched within the following three weeks, may be saved if, instead of drumming the remaining bees off at once, this operation is deferred for twenty-two days, to allow all worker brood to hatch out. By this time there will be a young fertile queen, and the bees, after being drummed off, are hived on frames in the same way as the swarm, if increase is desired, or, if not, the old queen which went with the swarm may be removed from the frame hive and the driven bees with the young queen united with the bees of the frame hive by running them in towards evening after blowing a puff of smoke into the hive.

When re-uniting, as described, is intended, it is best to hive the swarm, in the first instance, on the spot occupied by the box hive from whence it came and place the old box alongside, with the entrance facing in a different direction from that of the frame hive. This will serve two purposes—first, the old bees which remained in the box after the swarm left it, when returning from their foraging flights, will go to the spot they are used to and join the swarm, with the result that no after swarm will come from the box hive; and, secondly, there will be no bees flying back after uniting, as would be the case if the new and the old hive were some distance apart.

Transferring at Robbing Time.

All hives do not swarm every year, and there may be a number still left in box hives when the swarming season is over. These may be

transferred at the time usually selected for robbing by box hive bee-keepers. At this time, which varies in different localities and seasons, there is generally a maximum of honey and a minimum of brood, so that the saving of it is of no great consequence, and the transfer is best effected by robbing the boxes in the usual way, but putting the bees into frame hives instead of empty boxes. If any of the stocks are too small, two may be put together into one frame hive. As far as possible, adjoining boxes only should be united, otherwise the bees which had their hive taken away altogether will enter the hive nearest their old location. Hives which did not swarm during the season, and particularly those which are weak in bees, may be suspected of disease. The box should be raised on one side and a piece of brood comb broken out, the box lowered again, the comb taken indoors and carefully examined for foul-brood This is done by removing the caps of some of the brood cells, especially those which look darker than the surrounding ones, and any that have sunken in instead of raised caps. This pricking open of the cells should be done with a toothpick, a wooden match, or straw. Healthy larvæ are of pearly whiteness and plump; diseased ones are yellowish, grey, or brown, and flabby in appearance, and, later, collapse into a shapeless brown mass, which, when touched with a match, draws out stringy or ropy. This disease is often, but not always, accompanied by an odour of stale glue.*

Any colony found diseased and with not sufficient bees left to form a medium swarm should be at once destroyed by burning the box, bees, combs, and all. The bees should be shut in when they have stopped flying for the day, and the whole hive burned on a fire in a hole dug for the purpose, which is to be filled up with earth when everything is consumed.

If a diseased hive still contains sufficient bees to form a swarm, they may be drummed off into an empty box, in which they should be left for three or four days to cleanse themselves. The bees are then transferred to a frame hive like an ordinary swarm. The old box and contents should be burned as soon as the bees are driven out, and the intermediate hive cleaned by immersion in boiling water.

Robbing box hives for the purpose of transferring the bees to frames should not be done too late in the season, so as to give them a better chance to establish themselves before winter.

On no account should honey or comb, wax, or refuse from the box hives be given to the bees, nor should they be allowed to have access to it. The cutting out of combs, the straining of honey, and the rendering of wax should all be done indoors, secure from bees, or when that is not possible, it should be done at times when bees are not flying and all honey, wax scraps, or daubed utensils should be removed, or carefully and securely covered up, when the work is finished.

It may here be pointed out that the practice of many box hive bee-keepers of leaving comb too dark for the straining bag lying about, straining honey out of doors, or even purposely putting scraps of comb and sticky refuse out for the bees to clean up, has, since foul-brood has been introduced to Australia, caused the loss of thousands of

* For symptoms of Foul-brood and its treatment see *Journal of Agriculture*, June, 1913, page 367, or apply for pamphlet "Foul-brood of Bees," posted free on application to the Department of Agriculture

colonies of bees and the wholesale dissemination of that disease. Even the bees' nests in trees first became infected in this way. The subsequent felling and robbing of bee trees by bee hunters, who left the refuse exposed to other wild bees, box hive, and frame hive bees, caused a still wider distribution of foul-brood.

It is not natural for bees to find honey. They gather nectar from the blossoms; this they transform into honey inside the hive. When they find honey outside they become excited; when the supply is exhausted they forage around for more; they find weak, usually diseased colonies, or bee trees, somewhere within their range of flight; they attack these and carry home their stores of honey, and with them the germs of foul-brood.

If feeding bees is necessary, as it may be in the case of late transfers, sugar syrup (2 sugar to 1 boiling water by weight) should be given in a feeder inside the hive, not honey outside. Sugar syrup does not excite bees so much as does honey, and can be relied upon as being free from disease.

Transferring Bees and Combs.

Any one who understands bees well, and has sufficient experience in disease to enable him to detect the very first trace of it, can transfer box hive bees to frames at any time during the active season by cutting out any of the combs of brood in the box hive which are straight enough and fitting them into frames. The pieces of comb are held in position either by means of string tied over the frame and comb, or thin splints of wood tacked to the frame. These temporary supports may be removed as soon as the bees have fastened the combs to the frame. It is seldom that more than two or three frames can be filled with brood from a box hive; the rest of the frames are supplied with starters or full sheets of foundation. As the bees become established on newly-built combs the frames of transferred combs are gradually worked to the outside of the cluster of bees, or put into the upper story over a queen-excluding honey board, and when all the brood is hatched out of them they are best withdrawn from the hive and melted for wax.

While this method saves most of the brood and transfers everything in one operation, it is a very messy one. There is always a risk of transferring disease to the new hive along with the brood or comb, and the transference of brood and comb should, therefore, not be undertaken by any one not possessed of the requisite knowledge and skill.

(*To be continued.*)

Correction.

On page 569, *Journal of Agriculture* for September, 1913, "Yields and returns of the Government Herd of Red Poll Dairy Cattle." The third column of test figures should be read "Milk in gallons" in each case. Also, the average value for season 1912-13 should be £11 16s. 5d.—Editor.

PRINTED LABELS AND WRAPPERS FOR EXPORT FRUIT.

J. G. Turner, Chief Horticultural Officer.

The use of plain and coloured labels and wrappers in the packing of export fruit has long been a prominent feature of the American and Italian trade. Under the keen competition that exists in those older fruit-growing countries, every device for arresting the attention and securing the trade of the world's markets has long been resorted to. The shipper with the best eye for advertisement has scored over his rivals, and, accordingly, we find that his success has been, in nearly every instance, coincidental with the attractiveness of his advertisement. On American apple boxes, or in the Italian lemon cases received in Australia, we find some of the highest examples of the advertising art. The American shipper usually presents on the end of each fruit case a pictorial representation of his orchard or his district in colours that throw quite a glamour of beauty over the most commonplace details of every-day orchard life. The Italian packers place within their cases a printed cover presenting to the eye of the buyer a symphony in gold and colours; every fruit in the top row of the case is enveloped in tissue paper setting forth the name and address of the shipper printed in purple and gold, or other colours, and the lower layers are wrapped in papers printed in colours of, perhaps, humbler hue, but little less effective in the way of advertisement.

We in Australia have not yet reached so high a pitch of pictorial "push" in connexion with our wares; at any rate as far as our fruit is concerned. It is, perhaps, because we, so far, have enjoyed a comparative monopoly of the trade in our goods in the Old World markets But the signs are not wanting that ere long we will have to face the competition of countries who are just as favorably situated as ourselves. South Africa and South America have been recently planting enormous areas of fruit trees. This can be for only one purpose. It, then, is clearly our duty to give more attention to the matter of advertising our goods than we have done in the past. The present methods (dull stringy-bark cases and plain paper wrappers) are, no doubt, virtuously economical, but the average cases sent from Victoria are quite innocent of trade embellishment—even to severity. The wrappers enclosing the fruit are almost invariably devoid of the slightest attempt at advertisement.

It is usually pleaded that advertisement, or any other suggestion, "all adds to the expense," and "every farthing counts." If expense be the objection, it should be easily got over. Why not co-operate? This item of advertising is one that could be very well taken up by the growers of each district packing at one packing-house. In fact, it is at the district packing-house that such a form of advertising would be best carried out, for it is mainly in conjunction with fruits of uniform grade and the best quality that a high repute for reliability for the output of the whole district can be attained. One or two careless indifferent packers in a district may easily nullify the efforts

of well-intentioned careful packers. Buyers, and officials too, sometimes, are, unfortunately, largely led by the locality influence. It is well known that all fruits, whether from Tasmania, New Zealand, or Australia proper, are regarded by many of the foreign buyers as "Australian." The German authorities some years ago issued regulations aimed at all Australian fruits, because in one small lot the officials found traces of San Jose Scale. At San Francisco, too, the officers caused restrictions to be placed on Australian fruits because of the existence of fruit fly at certain northern ports in the Commonwealth. This all tends to illustrate the necessity for advertising locality. If your locality is one of the best for raising top-grade fruit, make the most of it and advertise.

On this subject the Agent-General has forwarded to the Minister for Agriculture a report which he received from Mr. N. W. Barratt, who has been inquiring into this matter of fruit wraps:—

Sir,

In accordance with instructions, I have interviewed various buyers, both at Covent Garden and London Bridge, with regard to the use of printed fruit wraps.

There is a general consensus of opinion that anything that will set the fruit off to better advantage is very desirable, since it is the first glance at the auction sales which impresses buyers. In fact, as one well-known buyer expressed it, "Anything which looks well and tends to a certain amount of deception in catching the eye causes a ready sale." And there is nothing like a well-packed case. If the fruit be packed in a paper printed in a design, and with a colour which will not obscure the actual fruit, the same is very effective. Of course, some of the lighter colours are not very noticeable, such as the silver and burnished wrappers used on lemons.

I have seen a wrapper printed in bronze blue, which is on a white background. This is used for a good class of orange coming from Italy, and is very effective.

The two best colours to work in designs on printed wraps are bronze blue and red. Both of these should be used on a white background.

With regard to Californian fruit, printed wrappers are universally used.

Some Australian fruit from Western Australia and Tasmania has been sent in these wraps, and the buyers noted same immediately, with the result that the brand, being easily recognised (and the fruit good), has attained a great degree of popularity. Of course, if printed covers are used, the fruit should only be of the best, as otherwise nothing would be gained—the wrapper (printed) thus being recognised as a distinctive mark of quality.

With regard to the matter to be printed on a wrapper, various ideas have been suggested, *e.g.*, map of Victoria, with red dot on the part of the country from which the fruit comes. (This design is in use by a Tasmanian grower.) Then various lettering could be employed, such as "Finest grade fruit, best in the Colony or State," or "From Happy Valley Orchards," &c., or any such phrases which would be likely to catch the public eye.

The buyers here always forward the fruit with the wrappers on. These are often retained even by the shopkeepers, as anything wrapped in fine paper with a coloured design lends the idea that it is extra special.

Of course, there should be no indiscriminate use of the wrapper. It should be only used in connexion with the best class fruit. Otherwise, if buyers find that poor class fruit, or an inferior variety, is being packed, its effectiveness will be lost at once. An idea which has been suggested as a further means of advertisement is the use of a gaily-coloured card to be placed on the top of the fruit inside each case. This could be made either the size of the top of the case or smaller. This greatly adds to the finish in the packing. When the case is opened, the first thing seen is a bright design distinctive of the country of origin, with any choice lettering suggestive of the locality. This

immediately catches the eye, and has a good impression with buyers, besides giving the case a finished appearance. And, as previously stated, what is presented at auction with a pretty appearance will sell more readily than the less finished article. Because the buyer only gets a momentary look, and the idea left with him is that if a case is well finished off, the fruit must be of a fine quality.

I enclose such a card as is being used by a Californian grower whose plums are famous here.

Again, this card should be made of a firm material, so that it would be removed from the case and hung in a conspicuous way in either warehouse or shop. There is no doubt of the popularity of the idea.

In conclusion, the idea of printed wrappers seems to be popular, but the use must be restricted to best variety fruits, and the Government would do well to be able to guarantee same—this could be done by grading under Government inspectors.

I annex various wrappers and cards for inspection.

Your obedient, Sir,

(Sgd.) N. W. BARRATT.

The Agent-General for Victoria,
The Strand, 22nd May, 1913.

[Note.—The cards and wrappers referred to in Mr. Barratt's letter may be inspected, upon application, at the office of the Exports Superintendent, Department of Agriculture Produce Offices, 605-607 Flinders street Extension, Melbourne.]

A NEW STRAWBERRY PEST.

The Metallic Flea Beetle (*Haltica pagana*).

By C. French, Jun., Government Entomologist.

During the last few months, strawberry growers in the Wandin and Evelyn districts have complained of losses through the depredations of insects, which are small in size, measuring about one-eighth of an inch in length, and of a purple, metallic colour. They swarm in great numbers on the strawberry plants, and make numerous small holes in the leaves and the young flower buds, causing them to wither. On examination, I found that the trouble was caused by the Metallic Flea Beetle, a native insect which formerly fed on the leaves of the "Sheep Burrs" (*Acaena ovina* and *A. sangiusorbae*). This is another example of our native insects forsaking their natural food and attacking introduced plants. As raspberries, apples, pears, &c., belong to the same order of plants (*Rosaceae*) as the "Burrs," growers should keep a sharp look-out for these insects, as there is no telling what trouble they may cause.

Remedies.

Fortunately, in the arsenate of lead spray we have an excellent remedy for the destruction of these insects, but this mixture should not be used whilst the plants are fruiting. A deterrent such as benzole emulsion could be used. Kerosene emulsion is also a useful spray. Numbers of these insects could be shaken off the plants into shallow tin dishes containing some sticky substance.

THE CENTRAL RESEARCH FARM, WERRIBEE.

The Cabinet Committee, which reported in 1911 on the reorganization of the Department of Agriculture, recommended, as one of the means by which the Department could best advance the agricultural industry, the undertaking of a centrally-situated Government farm. The specific purpose of such farm is set out below, but the Committee specially desired that a feature of the project should be permanency of the experimental work, whereby the error effect of varying seasons and climate might be eliminated. In this respect it was designed that the Central Research Farm should stand to Victorian agriculture as the Rothamstead Station in England, and the State Experimental Stations in United States of America, stand to British and American agriculture respectively.

It was also recommended by the Committee that the Central Farm should constitute the hub of a system of district farms, the work at which should be of a character special to the district in which they were situated. The idea was that ultimately, during the next ten, or possibly fifteen, years, six or seven of such district farms should be established, one in each of the climatically different districts of the State. For the then present, however, it was recommended that efforts should be concentrated on the Central Farm and the district farms already held by the Department, viz.:—the Rutherglen Viticultural College Farm (900 acres) for the North-Eastern district, and the Wyuna Irrigation Farm (500 acres) for the Goulburn Valley district.

Accordingly, arrangements were made to take over from the Closer Settlement Board an unallotted portion of the Werribee Estate.

In a foreword to a guide-book issued on the occasion of the first Farmers' Field Day at the farm, the Hon. the Minister of Agriculture (Mr. Geo. Graham, M.L.A.) intimated to visiting farmers as follows:—

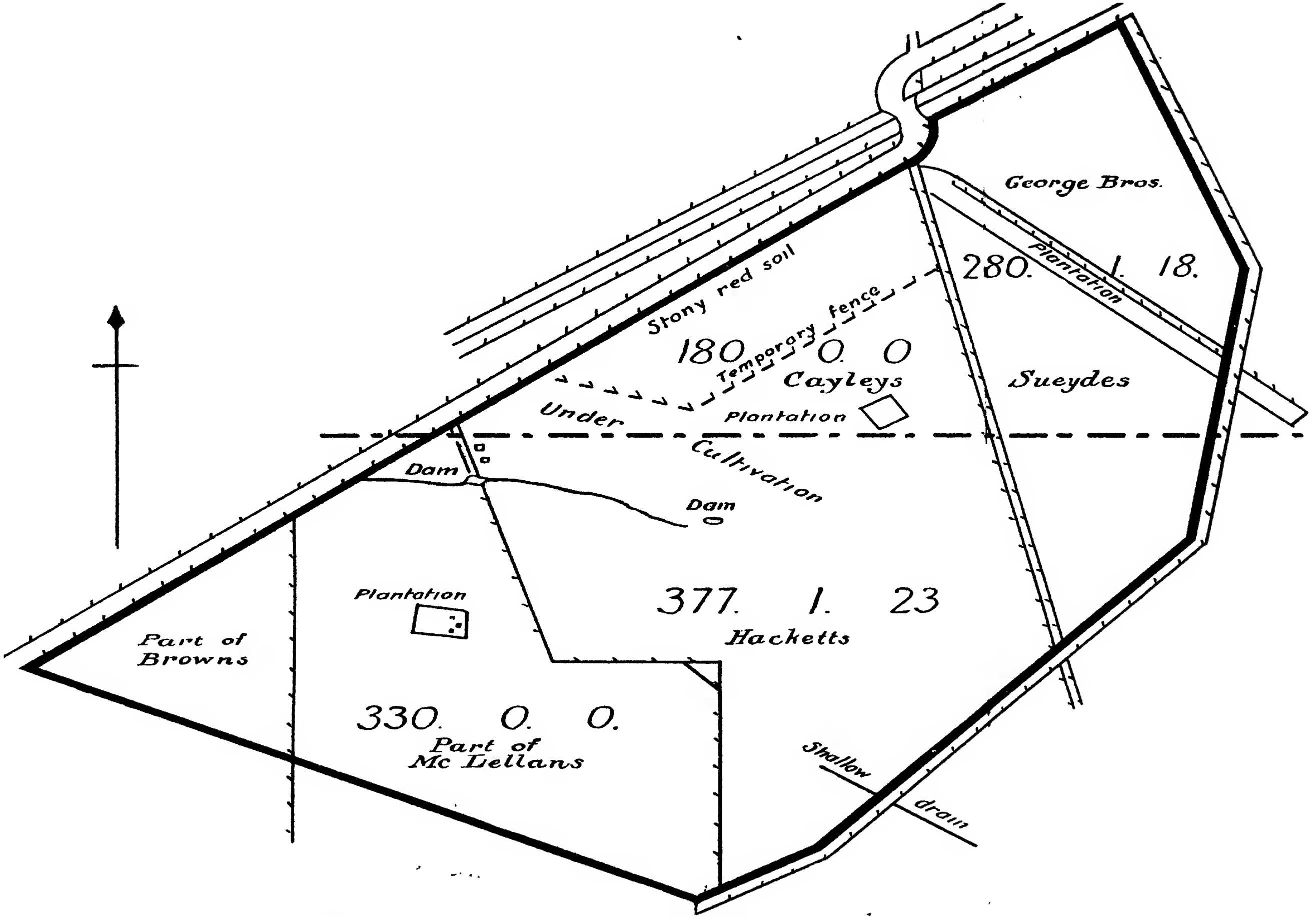
My impressions on two recent visits to the Central Research Farm were such that I felt it advisable that the farmers of the State, in whose interests the farm has been undertaken, should have an opportunity of knowing, by personal inspection of the work on the farm, one of the methods by which the Government proposes in future to promote the progress of agriculture, viz., the carrying out of accurately-controlled experiments and scientific researches, and the practical demonstration of such of the results as appear to warrant departure from present agricultural methods and practices. Furthermore, the Director of Agriculture (Dr. S. S. Cameron) and his able lieutenants, Mr. A. E. V. Richardson (Agricultural Superintendent) and Mr. H. C. Wilson (manager of the farm) were desirous that an account of their stewardship should be given to practical agriculturists, men whose assistance, support, and appreciation are necessary to the successful continuance of the work, and so I decided to inaugurate a Farmers' Field Day on the farm, which, I trust, may be found sufficiently interesting as to warrant its repetition as an annual event.

It should be remembered by visitors that only one season's work has been put in on a previously bare and uninviting area of land. With the exception of the established lucerne on the irrigation area, no results can yet be pointed to, but sufficient of the lay-out and developmental work can be seen as to indicate the objectives aimed at, and the capacity of the officers to carry out in a practical fashion the schemes they have initiated.

I have a confident trust that visitors will see much to interest them, and that their impressions will be such as to encourage the staff to continue the work and maintain its first year's workman-like standard.

GEORGE GRAHAM,
Minister for Agriculture.

5th September, 1913.



Plan A.—Central Research Farm, Werribee. Block of land as acquired by the Department of Agriculture from the Closer Settlement Board 1/7/12.

12536

CENTRAL RESEARCH FARM, WERRIBEE.

The Purpose of the Farm.

The Central Research Farm is being established to provide for permanent use by the Department of Agriculture, a farm on which to carry out research work, experiments, and practical demonstrations in all branches of agriculture and live-stock husbandry.

The work carried out will reflect the teachings and experience of the staff of the Department, and will be designed in its results to insure the promotion of sound and advanced agricultural practice suitable to the present and probable future circumstances of the State.

The purpose of the farm is not to attain financially profitable results so far as the farm itself is concerned, but to confer on agriculture the benefits of modern scientific advances by the prosecution of investigations and trials under practical and accurately-recorded conditions concerning the problems involved in increasing the agricultural output of the State, particularly as regards—

(*a*) Improvement of wheat and other cereals, grasses, and economic plants by selection, stud-breeding, and hybridizing;
(*b*) Soil renovation, fertilizing and tillage methods;
(*c*) Rotation of crops and improved cropping practices;
(*d*) Irrigation practices; drainage and aeration of soils;
(*e*) Improvement of natural pastures, and trials of artificial grassing with exotic and native grasses;
(*f*) The breeding and feeding of live stock, improvement of milk yields, production of standard export types of lambs.
(*g*) Research concerning soil moisture, temperatures, biological conditions, and nitrification processes; and the nutrition of plants;
(*h*) Meteorological observations relating to agriculture..

Location, Area, and Character of Soils.

The location has many advantages. The handiness of the area to Melbourne (18 miles), whereby close touch by the Department is facilitated, and easy access by farmers from all parts of the State is afforded; its proximity to Werribee railway station (1 mile), the long stretch of observation obtainable from the railway and Geelong-road, the fact that both dry farming and irrigation areas in proper proportion, as also comparatively good land and definitely poor land are included; all these are combined advantages that could not be secured elsewhere in the State. Much of the soil closely resembles in physical character and chemical analysis that of the Goulburn Valley and Wimmera cereal-growing districts, and the annual rainfall (19.5 in.) is practically the same.

The area of the farm is 1,167 acres, of which approximately 837 acres is poor to fair (grey-blue pug clay and shallow red stoney loam), and 330 acres fair to good (red volcanic loam 6 to 7 inches) overlying clay). About 200 acres of the latter land is irrigable, and commanded by the main farm channel.

The bulk of the land has been cultivated for many years past for growing oaten hay, and is in a worn-out condition—certain of the best land is known to have grown a crop continuously without a rest for the last 26 years. The deficiency of humus, indicated by the floury character of the soil after dry cultivation, and the hard setting on drying after rain, is also made apparent by the contrast between the paddock soil and that on the removed fence lines.

Subdivision and Developmental Work.

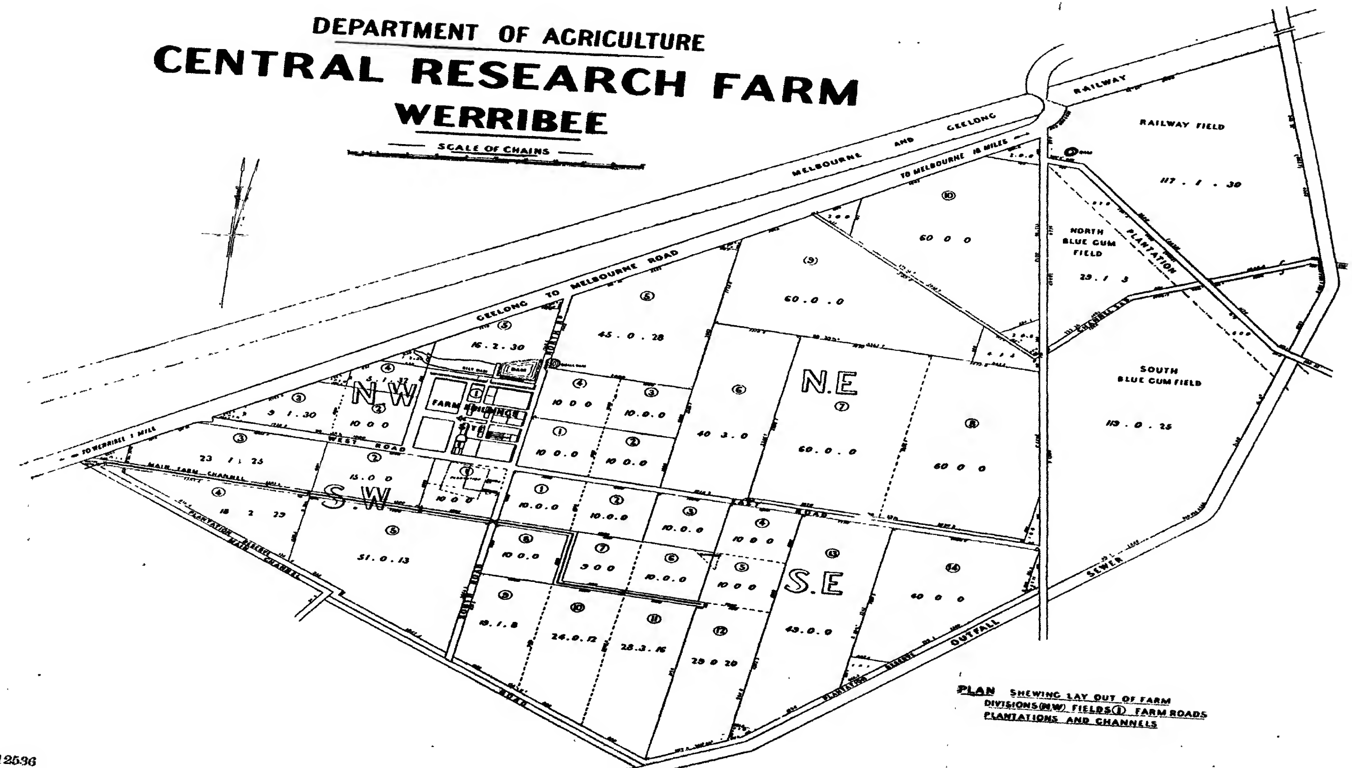
Possession was taken from the Closer Settlement Board on 1st July, 1912. At that time the area comprised five large paddocks of irregular shape (see Plan A). Plan B shows the subdivision in course of being carried out. Primarily the area is divided by north-south and east-west roads into four divisions, designated respectively N.E. (north-east), N.W. (north-west), S.E. (south-east), and S.W. (south-west). The plan provides for the further subdivision of these areas into paddocks, 30 of which have been already surveyed and fenced. Upwards of 25 miles of fencing have been erected during the year. The paddocks are for the most part rectangular in shape, and comprise areas of 10 acres or multiples of 10, in order that calculations and comparisons of crop yields may be facilitated.

In subdividing the farm, attention has been paid to securing, as far as possible, an even quality of soil for each set of permanent experiments, and also to the balancing of distances in relation to the farmsteading, which occupies a site on the highest level, and has drainage falls in two directions.

During the first year the developmental work has been directed to the provision of a water supply by the scooping of a small lake and silt dam, the formation of roads, the subdivision of the property by fences, the construction of water channels, the planting of shelter belts, and the ploughing, cultivation, and sowing of 550 acres of crop, comprising wheat, oats, barley, lucerne, peas, vetches, rape, mixed forages, and grass. Sixty-five acres of land have been graded, and of this 50 acres have been sown to lucerne, whilst 15 acres are reserved for summer crops. Two hundred acres have been fallowed for 1914 cropping, and another 100 acres are being undertaken, leaving, approximately, 310 acres devoted to pasture, plantations, roads, and steading.

Lay-out of Experiment Work.

As previously indicated, the main function of the farm is that it shall serve as a centre for the conduct of experimental and research work bearing on agricultural practice, but of course a large amount of pioneering work necessary to get the place in order for these purposes has had to be done. Nevertheless, a lesson of some kind has been designed in every field dealt with.



Plan B.—Present Subdivision of Area.

The principal experiment work undertaken comprises:—

I.—Dry Farming.

II.—Irrigation.

DETAILS OF EXPERIMENTAL WORK—DRY FARMING.

Section 1.—Permanent Rotations, Field 3, S.W.

(See Plan C, page 597.)

These comprise for 1913 a series of 26 half-acre plots, designed to test the merits of different systems of cropping under the conditions which prevail in the district. This series of plots may be described as a test of different systems of farming. For the present, ten different systems of crop rotation have been commenced, but provision has been made for the addition of further rotations next season. These plots are to be permanent, and comprise the following:—

Note.—Oat plots, sown 10th April. 70 lbs. Algerian oats and 120 lbs. super per acre.

Pea plots, sown 11th April. Variety Tasmanian Grey. Seed, 75 lbs. per acre. Super, 120 lbs. per acre.

Barley, sown 11th April. 70 lbs. per acre. Super, 120 lbs.

Rape, sown 12th April. Dwarf Essex. 7 lbs. per acre. 120 lbs. super

Wheat, sown 15th May. 66 lbs. Federation. 120 lbs. super.

I.—*Wheat continuously*—Plot 1.

Plot 1. Wheat 1913, wheat 1914, wheat 1915.

II.—*Wheat after Bare Fallow*—Plots 2 and 3.

Plot	2.—Wheat 1913,	bare fallow 1914.
,,	3.—Bare fallow 1913,	wheat 1914.

III.—*Wheat after Forage*—Plots 4-6.

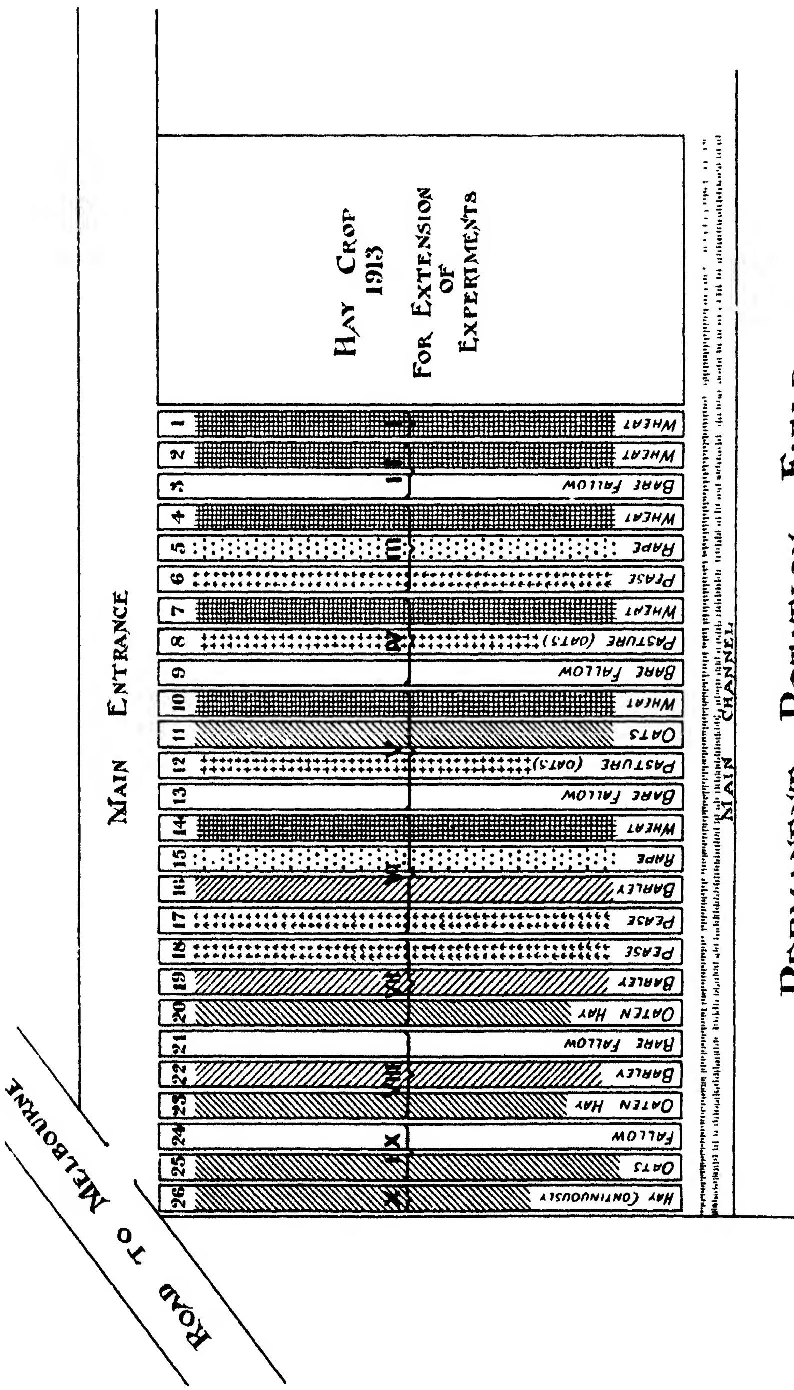
Plot	4.—Wheat 1913,	rape 1914,	peas 1915.
,,	5.—Rape 1913,	peas 1914,	wheat 1915.
,,	6.—Peas 1913,	wheat 1914,	rape 1915.

IV.—*The Mallee Rotation.*—Wheat, pasture, bare fallow. Plots 7-9.

Plot	7.—Wheat 1913,	pasture 1914,	bare fallow 1915.
,,	8.—Pasture 1913,	bare fallow 1914,	wheat 1915.
,,	9.—Bare fallow 1913,	wheat 1914,	pasture 1915.

V.—*The Wimmera Rotation*—Wheat, oats, pasture, bare fallow. Plots 10-13.

Plot	10.—Wheat 1913,	oats 1914,	pasture 1915, bare fallow 1916.
,,	11.—Oats 1913,	pasture 1914,	bare fallow 1915, wheat 1916.
,,	12.—Pasture 1913,	bare fallow 1914,	wheat 1915, oats 1916.
,,	13.—Bare fallow 1913,	wheat 1914,	oats 1915, pasture 1916.



PERMANENT ROTATION FIELD

Plan C.

VI.—*Cereals after Forages*—Plots 14-17.

Plot 14.—Wheat 1913,	rape 1914,	barley 1915,	peas 1916.
„ 15.—Rape 1913,	barley 1914,	peas 1915,	wheat 1916.
„ 16.—Barley 1913,	peas 1914,	wheat 1915,	rape 1916.
„ 17.—Peas 1913,	wheat 1914,	rape 1915,	barley 1916.

VII —*Oaten Hay after Forages*—Plots 18-20.

Plot 18.—Peas 1913,	hay 1914,	barley 1915.
„ 19.—Barley 1913,	peas 1914,	hay 1915.
„ 20.—Oaten hay 1913,	barley 1914,	peas 1915.

VIII.—*Oaten Hay after Cereals and Fallow*—Plots 21-23.

Plot 21.—Bare fallow 1913,	hay 1914,	barley 1915.
„ 22.—Barley 1913,	bare fallow 1914,	hay 1915.
„ 23.—Hay 1913,	barley 1914,	bare fallow 1915.

IX —*Oaten Hay after Bare Fallow*—Plots 24-25.

Plot 24—Bare fallow 1913,	hay 1914.
„ 25.—Oaten hay 1913,	bare fallow 1914.

X.—*Oaten Hay continuously year after year.*

Plot 26.—Oaten hay 1913, hay 1914, hay 1915.

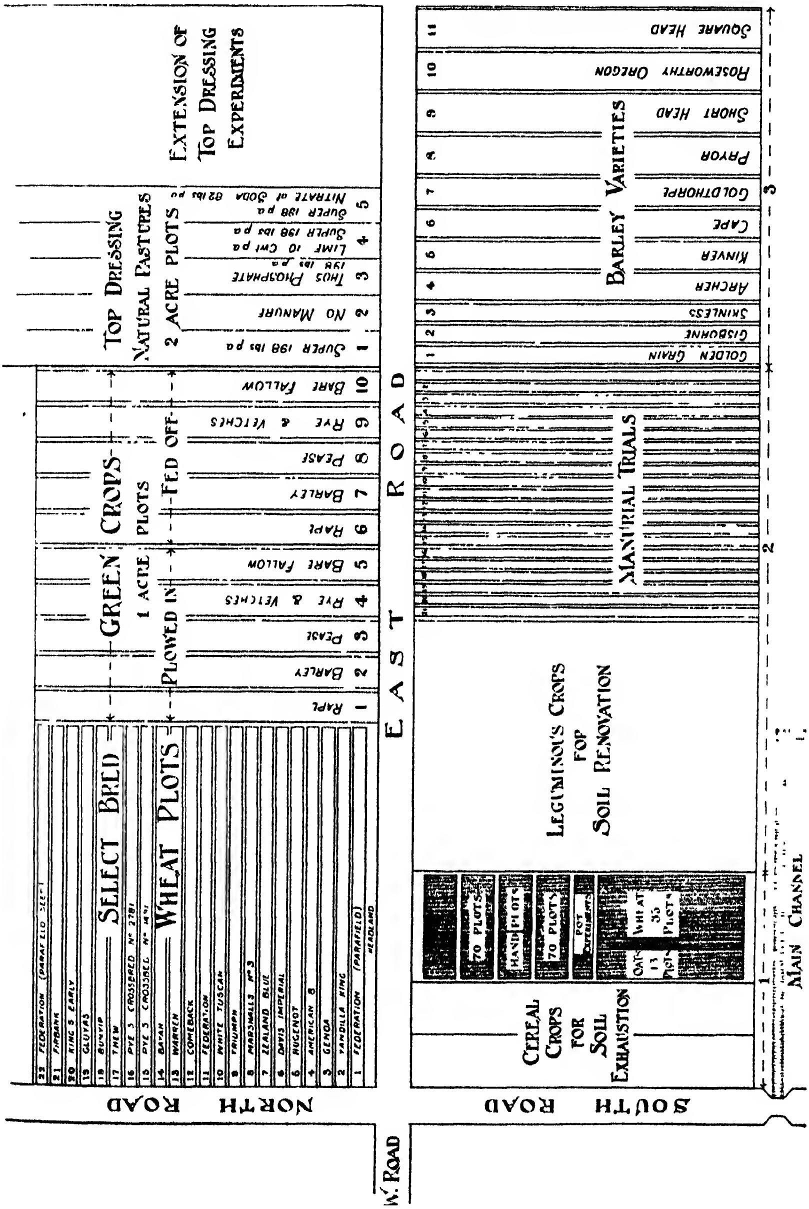
These plots are designed to test the merits of the different systems of crop rotation indicated, and the most profitable rotation will be that which enables the land to yield the best financial returns throughout a series of years. This will be determined by the keeping of accurate records, in which the cost of working each plot will be entered at current market rates, and it may be assumed that whatever holds true through a cycle of rotations on the Permanent Rotation Field will also be true if applied to, say, 100 acres.

Section 2.—Cereal Experiment Fields.

(See Plan D, page 599.)

(*a*) Cereal Stud, Selection, and Crossbred Plots (Field 1, S.E.).

These occupy about one and a half acres, and comprise a series of some 400 small plots devoted to stud wheats, barleys, and oats, and new crossbred wheats. A large number of selected cereals have been obtained, by exchanges, from Departments of Agriculture and Experiment Stations in the United States, Canada, Germany, India, and Russia, and these have been sown in small trial plots. It is anticipated that some of these, after acclimatization, will be of direct value and worthy of wider trial in the State. Thus one variety of wheat—American 8—which may be seen growing on the Select-Bred Wheat plots (Field 1, N.E.), under field conditions, has proved the best



Plan D.—Cereal Fields, 1913. 1, 2, 3 (S.E.), and 1, 2, 6 (N.E.).
Central Research Farm, Werribee.

among 24 American varieties, and was a very prolific yielder at Rutherglen last season.

Besides these foreign wheats, a complete collection of standard Australian varieties has been sown. These form the stud plots for improvement by systematic selection and cross-breeding. Finally, a number of new crossbred wheats of different generations, are undergoing competitive trials, and have been sown in long rows. Check rows of Federation wheat have been sown at regular intervals for comparative purposes: 132 first generation crossbreds, 76 second generation crossbreds, and 82 fourth generation crossbred wheats are undergoing trials

Pot Experiments to Determine the Water Requirements of Crops.

Within the railed enclosure in this section are a series of pot tests for determining the total amount of water required by wheat, barley, oats, rape, and lucerne at various stages of growth from germination to maturity. These pots are weighed regularly every week, and by calculation the exact amount of water utilized by each crop at each and every stage of its growth can be accurately determined. Incidentally these tests will demonstrate how much water must actually pass through the roots, stems, and leaves (by transpiration) of our common farm crops under Australian conditions in order to build up a given amount of dry matter—say, a ton of hay, or a 20-bushel crop of wheat. Check pots in fallow are provided for comparative calculations.

Meteorological Records.—(Located for the present in an enclosure on the south side of the manager's cottage.)—Within this enclosure may be seen the arrangements and instruments for taking the following meteorological records:—

1. Daily maximum and minimum air temperatures.
2. Daily humidity of the air.
3. Daily evaporation.
4. Maximum and minimum soil temperatures at a depth of 1 inch, 6 inches, 12 inches, and 24 inches.
5. Amount of bright sunshine each day.
6. Daily rainfall.

(*b*) PERMANENT FERTILIZER TRIALS (FIELD 2, S.E.).

(See Plan D, page 599.)

These comprise a series of forty plots in all, of which 21 are to be cropped in alternate years, and the remaining 19 either fallowed or sown with green crops. The plots are each ¼-acre in area, and are designed to be permanent, *i.e.*, the same manurial treatment will be continued on each plot for a number of years.

Nineteen plots are sown on fallowed land each year, whilst two are continuously cropped, and one of these continuously cropped plots will be unmanured and one treated every year with superphosphate.

The following table gives the scheme of the plots:—

Plot 1.—Super., 1 cwt. per acre.
" 2.—Farmyard manure, 10 tons.
" 3.—Farmyard manure, 10 tons, and lime, 10 tons.
" 4.—No manure.
" 5.—Super., ½ cwt. per acre.
" 6.—Super., 1½ cwt.
" 7.—Super., 2 cwt.
" 8.—Super., 1 cwt., and nitrate of soda, 49 lbs.
" 9.—Super., 1 cwt., and nitrate of soda, 49 lbs. (in spring).
" 10.—Super., 1 cwt. (check plot).
" 11.—Super., 1 cwt., and sulphate of potash, ½ cwt.
" 12.—Super., 1 cwt., sulphate of potash, ½ cwt., and nitrate of soda, ½ cwt.
" 13.—Bone fertilizer, 1 cwt.
" 14—Thomas' phosphate, 1 cwt.
" 15.—Super., ½ cwt., and Thomas' phosphate, ½ cwt.
" 16.—Super., 1 cwt., and lime, 5 cwt.
" 17.—Super., 1 cwt., and lime, 10 cwt.
" 18.—Super., 1 cwt., and lime, 20 cwt.
" 19.—Super., 1 cwt. (check plot).
" 20.—No manure. (To be continuously cropped.)
" 21.—Super., 1 cwt. (To be continuously cropped.)

(NOTE.—Federation wheat sown on all plots, May 12-14th, 68 lbs. of seed per acre drilled with fertilizer stated below. Plots 3, 16, 17, and 18 limed 1st May.)

The permanent character of these plots make them more important than the usual fertilizer trials. On every occasion on which these plots come under crop, the manurial dressing applied to each will be the same. The effects due to the different dressings of fertilizers will become more and more noticeable as the years go by, and interesting changes in the fertility of the soil in the various plots may be looked for. Thus it will not only be possible to determine the immediate effect of the various fertilizers, but the cumulative effect as well,and the general influence of each fertilizer on the quality and stock-carrying capacity of the resultant pasture.

It will be noted that comparative tests are being made with different forms of phosphatic manures, also with nitrogenous, potassic, and farm-yard manures, and, in addition, the effects of varying quantities of lime and of water soluble phosphate are being compared.

(c) BARLEY VARIETY TESTS (FIELD 3, S.E.).

(See Plan D, page 599.)

These comprise ten different varieties of pure-bred barleys, sown for the purpose of testing the suitability of each variety to the local conditions.

The varieties undergoing trial are:—Golden Grain, Gisborne, Skinless, Archer, Kinver, Cape, Goldthorpe, Pryor, Short Head, Roseworthy Oregon, Square Head.

(*d*) Select-bred Wheats (3rd Year Selection).

(See Plan D, page 599.)

This section comprises 22 plots of approximately ½ an acre each, with 20 varieties of select-bred wheats, obtained by careful hand-selection from pure-bred stocks. Three check plots of Federation have been sown for purposes of comparison.

The varieties are:—

Plot 1.—Federation (Parafield Seed).
„ 2.—Yandilla King.
„ 3.—Genoa.
„ 4.—American 8.
„ 5.—Huguenot.
„ 6.—Dart's Imperial.
„ 7.—Zealand Blue.
„ 8.—Marshall's No. 3.
„ 9.—Triumph.
„ 10.—White Tuscan.
„ 11.—Federation.
„ 12.—Comeback.
„ 13.—Warren.
„ 14.—Bayah.
„ 15.—Pye's Crossbred 1491 (Commonwealth).
„ 16.—Pye's Crossbred 2781 (Currawa).
„ 17.—Thew.
„ 18.—Bunyip.
„ 19.—Gluyas.
„ 20.—King's Early.
„ 21.—Firbank.
„ 22.—Federation (Parafield Seed).

(For notes on the characteristic qualities of these wheats see p. 606.)

The best of these varieties will be carefully harvested and sown in large plots next year for distribution to farmers.

Note.—These wheats were sown in May, at the rate of 65 lbs. of seed per acre, with 1¼ cwt. of superphosphate.

(*e*) Green Manurial Trials and Feeding-off Tests.

(Fields 1 and 2, N.E. See Plan D, page 599.)

The soils of this farm, in common with those of the older cultivated wheat lands of this State, have become depleted of much of the organic matter they formerly possessed by continuous cereal cropping. This is apparent not only from the increased difficulty of ploughing the old lands as compared with virgin land, but also by the fact that the virgin land is more productive than the cultivated land. A striking instance of this may be seen in the cereal fields where a strip of land 2 yards wide and 40 chains long, representing the virgin soil on each side of an old line of fence, is growing a remarkably heavy crop as compared with the depleted soil on either side of the old fence line. The de-

pletion of the organic content of the soil consequent on repeated cropping with cereals is a serious problem, and experiments are being undertaken in the green manurial and feeding-off tests to determine the most practicable means of restoring the soil to its former level of fertility. The depletion of organic matter can be arrested in three ways—(1) by the direct application of farmyard manure, (2) by the ploughing in of green crops, and (3) in feeding-off of forage crops and the ploughing in of the residue.

The application of farmyard manure as a means of achieving this object is generally impracticable, especially on wheat farms, since the average holding is so large in comparison with the amount of manure produced on the farm. Improvement by means of green manures and feeding off is within the range of economical practice, and the object of the tests in this section is to compare the values of these two methods of soil renovation, side by side with the orthodox bare fallow.

There are twenty plots of 1 acre each in this section, and in alternate years ten plots are to be sown in wheat and ten under green forages and fallow. Each of the forages used is grown in duplicate plots, of which one plot is regularly fed off, whilst the other is ploughed in. By alternating the ten forage plots with the ten wheat plots each year, comparative results will be obtained of the value of the wheat after each of the forages when fed off as compared with wheat following the same forages when ploughed in.

The following plots have been laid down in this section:—

Plot.	1913.		Plot.	1914.	
1.	Rape	Ploughed in	1.	Wheat	
2.	Barley		2.		
3.	Peas		3.	"	
4.	Rye and Vetches		4.	"	
5.	Bare Fallow		5.	"	
6.	Rape	Fed off	6.		
7.	Barley		7.	"	
8.	Peas		8	"	
9.	Rye and Vetches		9	"	
10	Bare Fallow		10.	"	
11.	Wheat		11	Rape	Ploughed in
12.	"		12.	Barley	
13.	"		13.	Peas	
14.	"		14.	Rye and Vetches	
15.	"		15	Bare Fallow	
16.	"		16	Rape	Fed off
17.	"		17.	Barley	
18.	"		18.	Peas	
19.	"		19.	Rye and Vetches	
20.	"		20	Bare Fallow.	

NOTE.—Forage crops—Rape, barley, rye and vetches, and peas, sown on 8th and 9th April.

1. Rye, 70 lbs.; vetches, 35 lbs.; rape, 5½ lbs.; barley, 65 lbs.; peas, 75 lbs. per acre. Manure, 120 lbs. per acre.

The object of having the two fallowed plots in this section is to compare the crop of wheat obtained after forage crops ploughed in, and forage crops fed off, with the crop obtained after bare fallow. All the forage plots received a dressing of superphosphate, and, in order that any increased wheat crop obtained next year after these forages, as compared with the crop obtained from bare fallow, might

not be ascribed to the indirect influence of the superphosphate, one of these bare fallow plots (Plot 5) received the same dressing of superphosphate as that given to the forage crops, whilst the other bare fallow plot (Plot 10) was left unmanured for comparison.

Feeding-off Records.—While increased crops of wheat may result from the ploughing in and feeding off of forage crops, as compared with bare fallow or systems of continuous cropping with cereals, it would be of little advantage to the farmer if the increase of crop were insufficient to cover the extra cost of working the land. Accordingly, efforts are being made to estimate the exact value of the green forage fed off by conducting properly-controlled feeding trials with sheep, and placing the forage value against the increased cost of cropping. For this purpose, as many young sheep are turned on the plots as will properly utilize the fodder. The sheep are individually weighed on and off the plot, and the increase of live weight noted. For every increase of 1 lb., 1½d., say, will be allowed, according to the market value at the time. Further, an allowance of 1½d., say, per head per week for the wool will be made, irrespective of the increase in live weight.

As indicated above, the design of these plots is to demonstrate in what manner the organic matter of the soil (the most valuable soil ingredient) may be restored.

Section 3.—Grass Seeding Trial (Field 4, S.E.).

A 10-acre block has been laid down with permanent pasture grasses, comprising rye grass and clovers and prairie grass and clovers, sown May, 1913.

Section 4.—Top-dressing of Natural Pastures (Field 6, N.E.).

(See Plan D, page 599.)

The natural pasture on this farm is extremely poor and of low stock-carrying capacity. The quality of the natural herbage growing in any given district is largely dependent on the quality of the soil. Whether the stock-carrying capacity of the soil can be materially and profitably improved by top-dressing with various manures is the object of this experiment. At present five plots of 2 acres each have been laid down, comprising:—

1. Superphosphate, 2 cwt.
2. No manure.
3. Thomas' Phosphate, 2 cwt.
4. Lime, 10 cwt. and Super. 2 cwt.
5. Super. 2 cwt., and Nitrate of Soda, 1 cwt.

Provision has been made for extending the number of plots next season.

Section 5.—Legumes for Soil Renovation (Fields 1, 6, and 7, S.E.).

(See Plan D, page 599.)

In fields 1, 6, and 7 S.E., leguminous crops have been sown for soil renovation purposes. Though the winter has been extremely dry these crops have made fair growth, especially the mixed legumes in

1 (S.E.), in which a mixture of ½ bushel tick beans. ½ bushel vetches, ½ bushel peas were sown on 4th April. The contrast between the success of peas and other legumes wherever sown on the farm this season and the failure of rape wherever sown is most marked, and should constitute a very valuable object-lesson for local farmers.

Section 6.—Top-dressing Cereals with Nitrates (Field 2, N.W.).

On portion of the bulk hay crop nitrate of soda, 56 lbs., and sulphate of ammonia, 40 lbs., per acre have been applied as top-dressings to stimulate the growth of hay.

Section 7.—Fallow, 1913.

Fields 7 (60 acres). 8 (60 acres), and 9 (60 acres), N.E. have been ploughed for fallow, and it is proposed to fallow in addition Field 10 (60 acres) and the North Bluegum Paddock (40 acres). These paddocks have been ploughed with the mould-board and disc ploughs, and different depths of ploughing have been tried with each type of plough. The varying results, if any, on the crop to be grown on these fallows will be recorded at next year's harvest.

Section 8.—Lucerne for Pasture on Stubble (South Bluegum Field).

One hundred and three acres of oats for hay have been sown in five blocks with lucerne seed, at the rate of 6 lbs. per acre, according to the following scheme:—

Block 1.—(21.4 acres). This block was sown with Algerian oats at the rate of 2 bushels per acre, and after the crop was up the lucerne seed was broadcasted over with a Calhoun broadcaster, and the whole block rolled.

Block 2.—(21.4 acres.) This block was sewn with the same mixture of oats and lucerne; but in this case the lucerne seed was broadcasted on the crop immediately after the oats were drilled, and the whole block was then rolled.

Block 3.—(24.8 acres.) In sowing this block, the oats and lucerne seed were sown together with the superphosphate with the drill, and the seed was placed at a depth of about 1 inch, and then rolled.

Block 4.—(24.7 acres.) The oats, lucerne seed, and manure were sown with the drill, but the spouts were taken off, and the oats and lucerne allowed to drop from the box on to the soil. The whole block was then rolled.

Block 5.—(11.5 acres.) The same quantity of Algerian oats as on the other plots was drilled in on this block. No lucerne seed was sown.

The paddock on which these hay tests have been sown is one of the poorest on the farm, and its grazing value is very low. The object in sowing the lucerne with the oaten hay is to endeavour to increase the grazing value of the pasture after the hay crop is removed, and to assist in the process of soil renovation.

Section 9.—Bulk Wheats for Seed (Railway Field).

These comprise a series of eighteen varieties of wheat, sown in blocks varying from 2½ up to 10 acres in the Railway Paddock. These wheats may be seen from the railway carriage as it approaches the 18th mile-post on the eastern or bay side of the line.

The wheats in this series are true to type, and the yield is intended for distribution, in small lots, to farmers, so that plots may be sown by each to furnish his own bulk seed the following year. By so maintaining type, the deterioration of wheat varieties, which is continually noted, may be obviated.

The following is the order in which the varieties were sown on 19th to 22nd May:—

1.—Bobs—Produced by Farrer. An excellent milling wheat. Suited to coastal districts.

2.—Warren—This variety is suitable for both hay and grain, and is very prolific in the coastal districts of New South Wales.

3.—Marshall's No. 3—A very popular wheat, largely grown both for hay and grain.

4.—Gluyas—Very popular in the Mallee districts of South Australia, on account of its early maturity, its rust resistance, and drought resistance. A vigorous grower, but somewhat weak in the straw, and tends to grow down. Holds the grain well.

5.—College Eclipse—This is a variety of Carmichael's Eclipse, and is very much like Gluyas in its general characteristics.

6.—Penny—This variety yielded remarkably well on Tyrrell Downs last season.

7.—Yandilla King—This is a well-known late variety, with good stooling propensities, and is one of the best grain yielders.

8.—Dart's Imperial—This is one of the oldest varieties in cultivation at the present time. A good all-round wheat for grain and hay, and a heavy yielder in most districts. It is known more commonly as Bluey.

9.—Viking—An early variety enjoying considerable popularity in Mallee districts.

10.—King's Early—A vigorous, tall-growing variety, with semi-solid straw, and of good stooling capacity. Very popular in the dry districts of South Australia. It is bearded, but in spite of its beard it is prized as a hay wheat, on account of the solidity of the straw, sweetness of the hay, and the capacity to retain its colour well.

11.—Bunyip—A very early variety. A useful wheat to sow in dry districts when the season is late.

12.—Bayah—A Farrer wheat very similar to Federation in colour and general appearance and the short up-standing straw. A very vigorous grower and a good yielder. Not suitable for hay.

13.—Huguenot—Originated by Corroll, of Western Australia. It is a wheat of the macaroni or durum class. Somewhat poor stooler, but very tall grower. The hay is solid in the straw, and very sweet in character. Has given exceedingly heavy yields of hay. Much relished by stock. Needs to be sown thickly.

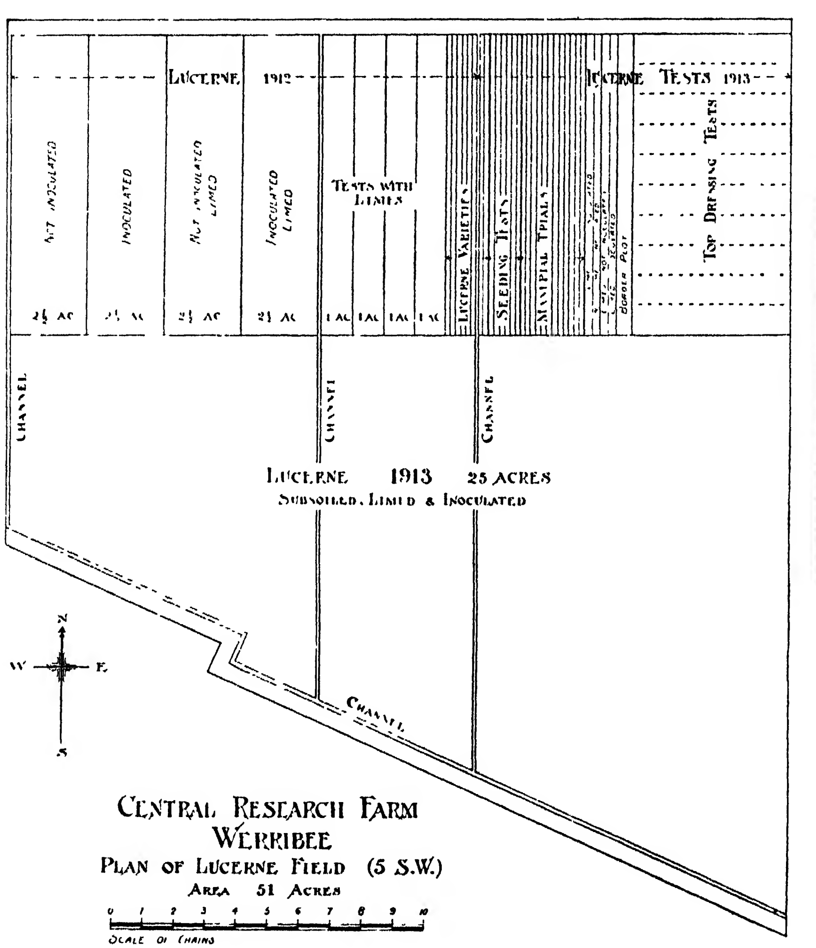
14.—American 8—A vigorous tall-growing variety, of good stooling capacity. A very promising wheat, valuable both for grain and hay purposes. It is the best of the collection of American wheats introduced some five years ago. Gave excellent yields at Rutherglen last season both of hay and grain. Good milling quality.

15.—Firbank—One of the most popular hay wheats in the Riverina, and for some years past the demand for seed of this variety has been unprecedented. An early, tall-growing, erect variety, of moderate stooling capacity, and good heavy flag. Makes very good quality hay, and gives a heavy cut. A very rapid grower, and is suitable for hay in dry districts.

16.—Genoa—A late, smut-resistant, cross-bred variety, produced by Farrer. Gives a very heavy yield when the spring rains are heavy. Suited for the cooler districts of the State. Very late variety.

17.—Zealand Blue—A very good hay wheat, produced by Berthoud, of Western Australia.

18.—Federation — One of the most popular and prolific varieties of wheat cultivated at the present day. Extensively grown in Victoria, New South Wales, South Australia, and Western Australia. A cross-bred wheat produced by Farrer, Department of Agriculture, New South Wales. It is essentially a grain yielder, and is not suited or recommended for hay.


Lucerne 1912
Lucerne Tests 1913
Not inoculated
Inoculated
Not inoculated limed
Inoculated limed
Tests with limes
Lucerne Varieties
Seeding Tests
Manurial Trials
Border Plot
Top Dressing Tests
2½ Ac
1 Ac
Channel
Lucerne 1913 25 Acres
Subsoiled, Limed & Inoculated
N
W
E
S
Central Research Farm
Werribee
Plan of Lucerne Field (5 S.W.)
Area 51 Acres
0 1 2 3 4 5 6 7 8 9 10
Scale of Chains

Plan E.

IRRIGATION AREA.

Section 10.—Lucerne Field (No. 5, S.W.).

(See Plan E.)

This comprises an area of 50 acres, of which 15 acres were sown in October, 1912, and the remainder between August 21st and September 5th, 1913. This area has been laid out in rectangular checks to insure the thorough and even application of water and to facilitate harvesting. The distance apart of the check banks varies from half-a-chain to a chain, according to the varying fall of the land. The whole of the grading and channeling has been done by utilizing three simple home-made implements:—(1) The slicker; (2) the checkbanker, and (3) the delver.

The lucerne sown in 1912 comprises 15 acres laid out as follows:—

(*a*) *Inoculation and Liming Tests*—

Plot 1.—2½ acres subsoiled, not limed, not inoculated.
„ 2.—2½ acres subsoiled, not limed, inoculated.
„ 3.—2½ acres subsoiled, limed, not inoculated.
„ 4.—2½ acres subsoiled, limed, inoculated.

(*b*) *Lime Tests*—

Plot 1.—One acre, no lime.
„ 2.—One acre, 30 cwt. lime.
„ 3.—One acre, 20 cwt. lime.
„ 4.—One acre, 10 cwt. lime.

(*c*) *Variety Tests (One acre)*—

Spanish.
Hungarian.
Peruvian.
Turkestan.
French Provence.
Arabian.
Salt Lake City (sown September, 1913).
Patagonian (sown September, 1913).

The lucerne tests sown this season cover 5 acres, and comprise:—

(*d*) *Rate of Seeding Trials*—

Plot 1.—Tamworth lucerne, 6 lbs. per acre.
„ 2.—Tamworth lucerne, 9 lbs. per acre.
„ 3.—Tamworth lucerne, 12 lbs. per acre.
„ 4.—Tamworth lucerne, 15 lbs. per acre.
„ 5.—Tamworth lucerne, 18 lbs. per acre.
„ 6.—Tamworth lucerne, 21 lbs. per acre.

(*e*) *Fertilizer Trials*—

Plot 1.—Lime 20 cwt., super. 2 cwt., blood manure 1 cwt.
„ 2.—Lime 40 cwt., super. 2 cwt.
„ 3.—Lime 20 cwt., stable manure.
„ 4.—Lime 20 cwt., super. 2 cwt., nitrate of soda 1 cwt.
„ 5.—Lime 20 cwt., super. 2 cwt., sulp. of potash 1 cwt.
„ 6.—Lime 20 cwt.
„ 7.—Lime 20 cwt., bonedust 2 cwt.
„ 8.—Lime 20 cwt., Thomas' phosphate 2 cwt.
„ 9.—Lime 20 cwt., super. 2 cwt.
„ 10.—Ground limestone 36 cwt.
„ 11.—Nil.
„ 12.—Super. 2 cwt.

(*f*) *Inoculation and Liming Tests*, 1913—

Plot 1.—Not limed, not inoculated.
„ 2.—Not limed, inoculated with 1 ton lucerne soil.
„ 3.—Not limed, inoculated with 2 cwt. lucerne soil.
„ 4.—Limed, not inoculated.
„ 5.—Limed, inoculated with 1 ton lucerne soil.
„ 6.—Limed, inoculated with 2 cwt. lucerne soil.

The lucerne area sown this year, other than the plots devoted to "Rate of Seeding Trials," has been seeded at the rate of 16 lbs. per acre with 2 cwt. of super., and has been inoculated with soil from Bacchus Marsh.

(*g*) *Top Dressing of Lucerne*—

Comparative effect of lime, ground limestone, gypsum, superphosphate, basic slag, bonedust, lime gypsum, ground limestone, potassic manures, nitrogenous manures, farmyard manures.

Preparation and Grading of the Lucerne Area, 1913.

The land was ploughed and subsoiled out of oat stubble in January in lands one chain wide, the crown of the land being the line of the final chain-wide check banks. Autumn-grown weeds were grazed off with sheep in May, and in June the cultivation preparatory to grading was commenced.

The whole area has been laid out in rectangular checks to facilitate watering and harvesting. The main check banks have been set out 1 chain apart at right angles to the contours. These checks were made with a specially-constructed check-banker, which implement may be inspected in the lucerne field. The cross checks are placed at intervals of ½-chain to 1 chain at right angles to the main checks according to the amount of fall. The fall in the lucerne field varies from 2½ to 4½ inches per chain. This fall necessitated the employment of frequent check banks.

FARM LIVE STOCK.

Lamb-breeding.—Last season 318 crossbred Riverina ewes of uniform type and quality were selected from a large flock. Each ewe was given a numbered ear-tag and separately weighed. The flock was then divided into six separate and even-weight lots of fifty, with three emergency ewes in each group to replace possible deaths. Each group was then mated with a different ram, with the object of finding out the most suitable ram for the breeding of export lambs. The rams used were Lincoln, Border Leicester, English Leicester, Shropshire, South Down, and Dorset Horn. Each group of sheep was placed in separate paddocks, but, in order to insure equality in feeding, the sheep were moved from paddock to paddock in regular rotation through the season and kept separate until the marking of the lambs was completed.

The lambing percentages were generally satisfactory, but a number of lambs were lost on account of the bleak cold winds, and the absence of shelter on the farm. Careful records have been kept of the dates of lambing, percentage of lambing, rapidity of growth in each group of lambs, &c. It is proposed to send half the lambs in each group to the freezing works, so that the weight and the value of the carcase may be determined. The other half of each group of lambs will be sold in the local market with a view of determining the market value of each group of lambs.

The experiment will be continued during this and the following season, and averages for the three years will then be obtained.

Dairy Stock.—The dairy herd of Red Poll cattle established by the Department four years ago at Whitfield was taken into stock at Werribee in June last. The herd is at present held at Boisdale, but will be transferred to Werribee when the silage crops are harvested in November.

It will be recognised that the pasture land on the farm is not suitable for dairying by grazing, but with the irrigation produce and the conserved fodders, it is the intention to carry out hand-feeding on a modified plan, and to conduct various tests on the relationship of hand-feeding to milk yields. The sale of young bulls from standard record cows to Victorian dairymen at a price based on the butter fat yield of the dam will be continued.

Horses.—All the working horses on the farm are Clydesdale-bred mares. So far no special stud mares are held, but a Clydesdale stallion, "Major Oates," was purchased this season to use on the farm mares and a limited number of district mares.

SEEDLING POTATOES.

By Geo. Seymour, Potato Expert.

[Report on the results obtained from the six parcels of pedigree potato seed forwarded to the Minister of Agriculture by Dr. Wilson, of St. Andrew's, Scotland, who was a member of the Scottish Commission which visited this State in 1911.]

From the accompanying illustrations it will be seen that the plants made a very vigorous growth, and that the tubers were large and of good shape.

Six different crosses were comprised; most of them are the result of working a red-skinned variety, sent from New Zealand, on a number of British sorts. They were as follows:—

No. 88.—Main Crop (3), New Zealand variety (2)
No. 99.—Up-to-date, a New Zealand variety (2), Myatt's Kidney, Main Crop.
No. 128.—British Queen, Myatt's Kidney, Main Crop (2), New Zealand variety (2).
No. 139.—Main Crop (2), New Zealand variety (2), Myatt's Kidney.
No. 155.—Cramond Blossom, Main Crop, New Zealand variety.
No. 177.—British Queen, Main Crop, New Zealand variety.

POTATO SEED.

A few seeds of each variety were planted on 23rd February, 1912, in pots. Germination was very satisfactory. The plants were removed from the pots on 6th April, and planted in a well-prepared garden plot. Early autumn frosts and dry weather interfered with the growth, with the result that the tubers produced were very small. No definite information can be formed as to the value of these new varieties for a season or two. It may be stated, however, that the flesh of most of them is yellow. By 1st June, all the plants except Nos. 155 and 177 had ripened off. The two latter appear to be very hardy plants. They resisted the frosts better than the others. The whole of the plants were lifted on 27th June, when the following particulars were noted:—

No. 88.—Tubers round, colour white, late maturing, stolons long.
No. 99.—Tubers round, colour of potato white, medium early, stolons long.
No. 128.—One plant tubers, kidney shape, all others round, white, early.
No. 139.—Tubers all kidney shape, white, early, stolons very short.
No. 155.—Tubers all round, white, late, vigorous plant, resisted frost.
No. 177.—Tubers all aerial, white, very late, vigorous plant, resisted frost.

These crosses are based on some of the leading disease-resisting, early, and main crop varieties, grown at the present time in England. Main Crop, Up-to-Date, Cramond Blossom, Myatt's Kidney, are all standard varieties which have stood the test of years.

The points sought in raising a new variety are that it shall be—

A good cropper.
Of good cooking quality.
A good disease resister.

The work of raising seedling varieties is generally regarded as very tedious work, requiring to be carried on for several years before tubers

THE PLANTS.

of any size are obtained, but, in this instance, they were nearly all of a fairly large size, many individual tubers weighing 1 lb. in weight, and very uniform in shape, some plants yielding 3 and 4 lbs. of fine tubers. The plants, some of which grew to an enormous size, measuring 4 ft. 6 in. to 5 feet in height, and of very robust growth, were raised at Burnley Gardens by Mr. Pescott, and were planted out on 21st November in my garden at Romsey. The season at first was very dry. During this period the plants were supplied with water artificially, but the autumn rains were ample.

The resulting crop comprises Very Early, Early, Midseason, and all late sorts. The plants of all the earlier sorts were small to medium in size, and the yield of tubers comparatively light.

The percentage of yellow-fleshed tubers is as follows—

No.	Per cent.
88	20.0
99	17.1
128	38.6
139	20.0
155	26.0
177	20.0
	23.6

Time of Maturity.

Each variety comprised Very Early, Early, Midseason, and late maturing sorts.

No.	Very Early and Early.	Medium, Early, and Midseason.	Late
88	32	16	52
99	25·7 (Not very early, 1 medium)	2·9	71·4
128	27·3	13·6	59·1
139	48·6	22·8	28·6
155	17·4	8·7	73·9
177	20	Nil	80
	28·5	10·7	60·8

Shape and Colour of Tubers.

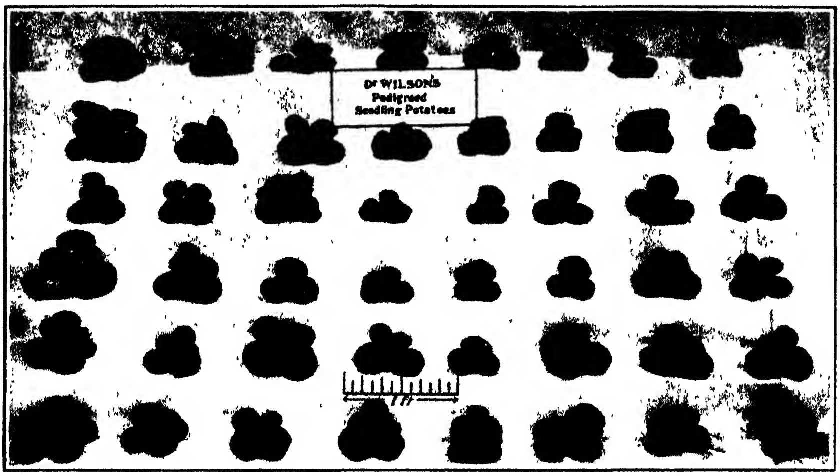
The tubers were various in shape—round, oval, and kidney shape, and true kidney. The following figures will show the percentage of kidney. Many of the plants had round and oval, and kidney and oval at the same plant. There was a marked absence of deep eyes. None of the varieties had very deep-eyed tubers.

No.	Percentage of Kidney.	Percentage of Pink Tubers.
	Per cent.	Per cent
88	12·0	16·0
99	28·5	5·0
128	31·7	4·5
139	37·1	3·0
155	27·2	21·7
177	13·3	0·0

With regard to the colour of skin, it should be stated that the ground was very wet when the crop was lifted, therefore many varieties that are classed as white skins may prove to be mottled with pink, or of a very pale pink.

Colour and Texture of the Flesh.

The percentage of white and creamy-fleshed tubers must be considered very satisfactory, in view of the fact that a yellow-fleshed potato does not find favour on the local market, whilst in France the preference is for a yellow flesh, and in England it is not objected to, because many of the finest flavoured tubers are yellow fleshed. Two of these may be mentioned - Duke of York (a very early variety), and Mid-



SEEDLING POTATOES.*

lothian Early. The former was imported by this Department in 1905, but, on account of inferior cropping capacity and yellow flesh, it never came on the market.

Stolons.

Among the objectionable features in potatoes is the habit of some varieties in producing their tubers on long stems or stolons, because when the tubers are scattered over a wide area around the plant, many are missed in harvesting the crop.

No	Short Stolons.	Medium Stolons	Long Stolons
	Per cent.	Per cent.	Per cent.
88	68·7	24·0	8·0
99	50·0	25·0	25·0
128 .	66·7	20·0	13·3
139 .	77·3	8·5	14·2
155	78·2	17·4	4·4
177 ..	73·3	20·0	6.7
Average ..	69 (	19·1	11·9

* See also illustration on cover of this Journal.

From the above it will be seen that the short stolons ranged from 50 per cent. to 78 per cent., with an average of 69 per cent. of all the varieties, and only about 11 per cent. were of the objectionable kind with long stolons.

Summary of Points.

Colour of Flesh.

White and Cream.	Yellow.	Total.
Per cent.	Per cent.	Per cent.
76·4	23·6	100.0

Earliness.

Very Early and Early	Midseason.	Late.	Total.
Per cent.	Per cent.	Per cent.	Per cent.
28·5	10·7	60·8	100·0

Length of Stolons.

Short.	Medium.	Long.	Total.
Per cent.	Per cent.	Per cent.	Per cent.
69·0	19·1	11·9	100·0

From the yields obtained, it is evident that many of them promise to be very prolific. Over 76 per cent. have good coloured flesh. Any not perfectly white are listed as cream. The texture of the flesh is very fine in most of the medium croppers, but rather coarse in the heavy-yielding sorts.

Sixty-nine per cent. had the desirable short stolons, and about 12 per cent. with the undesirable or long stolons.

No cooking tests were made. It would be of little value at this stage. As there was no late blight in the crops, the season being unfavorable for its development, no data under this head can be supplied.

The foregoing results show that great care in the selection and breeding of the parent plants must have been exercised by Dr. Wilson, for, out of the 210 plants raised, only three were rejected on account of producing a large number of very small, wild-looking tubers, and six stoloniferous plants, which had a mass of stolons with very few tubers.

The results from these seedlings bear testimony to the great possibilities in the crossing of different varieties of potatoes. It is doubtful if better results have ever been obtained before with such a large quantity of seedlings. Many authorities state that it often requires the raising of thousands of plants to obtain one desirable variety. Of course,

it is premature to speculate on the number of good varieties that may be obtained from the present lot--the future alone can prove that; but from such a large percentage of tubers presenting so many good qualities, it is not too much to hope that some will prove prolific croppers, of good cooking quality, and prove more resistant to disease than any at present grown here. Should this be the case, the potato growers of this State will be under a debt of gratitude to Dr. Wilson.

It may not be out of place to include in this report Dr. Wilson's letter to the Minister of Agriculture accompanying the parcels of seed. By so doing, readers will have a better grasp of the scope of Dr. Wilson's work, and the objects he has in view in carrying on this work. And, further, it may not be out of place to mention that since the date of his letter he has been permanently appointed by the West of Scotland Agricultural College to the work of crossing and breeding new varieties of pedigreed potatoes.

(Copy.)

Agricultural Department.

The University, St. Andrews,

3rd January, 1912.

The Agent General for Victoria.

When I was in Victoria as a member of the Scottish Agricultural Commission, I had occasion, at the instance of the Hon. G. Graham, and in company with Mr. McAlpine, to see the trouble that was caused by the existence of disease in potatoes. It so happens that I have been engaged for a considerable time in producing new varieties of potatoes, and during the past summer, when carrying on the work of crossing, it occurred to me that the best method of getting potatoes absolutely free from disease, and at the same time suited to the varying climatic and cultural conditions in Australia, would be to raise them from the seed taken from the berry.

I have accordingly made up sets of packets of seeds from my new varieties, with the object of sending selections to each of the States. The enclosed list will show that the seeds are "pedigreed." Each packet contains the whole of the seed taken from a single berry. If all the seeds are grown, they will produce a large number of varieties, of which a considerable proportion are certain to be of value to the Victorian grower.

The method of cultivation which I follow is to sow the seed in March in a pot, and place in heat. After the plants are large enough to handle, they are put singly into small pots. Re-potting is done at least twice, and the plants are planted out in the open in June, where they remain until they are matured. At lifting time, in September or October, each plant is found to bear 4 or 5 lbs. of full-sized tubers, and the less promising varieties can be eliminated then. Although the climatic and other conditions are quite different in Victoria, the foregoing may afford some guidance if it is needed.

It would have given me great pleasure to communicate this note direct to Mr. Graham, because of the recollections of pleasant hours spent in his company during our sojourn, and it would interest him to know that I am trying, in a small way, to make some recompense for the many benefits I received at the hands of the representative of the Department of Agriculture.

Please be so good as to forward the seeds.

I am,

Yours faithfully,

(Signed) JOHN H. WILSON.

Results of Experiments carried out with Dr. Wilson's Pedigreed Potato Seed.

By George Seymour, Potato Expert.

No	Habit of Plant.	Colour of Flower.	Shape of Tuber	Colour of Skin	Colour of Flesh	Time of Maturity	Character of Stolon	Remarks.
No. 88.								
1	Small		Oval	White	White	Very early	Short	
2	Medium		"	"	"	Midseason	"	Very fine tubers
3	Large		"	"	"	Late	"	
4	Medium		Round	Yellow	Cream	"	"	
5	Large		Oval	White to cream	"	"	Long	
6	Very large		"	Light-pink	White	"	"	
7	Medium		Kidney to oval	Pink	"	Very early	Short	
8	"		Oval	White	"	Midseason	"	Tubers very nice
9	Very large	White	Round	"	Cream	Late	Medium	
10	" "		"	White netted	"	"	"	
11	Very large and wiry		Oval	Pink	"	"	Short	
12	Large		Round	White netted	"	"	"	Tubers very nice
13	Very large		Oval	White	Very white	"	Medium	
14	Small		"	"	Yellow	Early	"	
15	Medium		"	"	"	Late	Short	
16	Very small		Oval and round	"	Cream	"	"	
17	" "		" "	"	"	Very early	"	
18	" "		Round and oval	"	Yellow	" "	"	
19	Medium		Kidney	Pink	"	Medium	"	Bad coloured flesh
20	"		Round, kidney, and oval	White	"	"	"	
21	"		Oval and round	"	Cream	Very early	"	
1 (*a*)	Large		Oval	"	White	Late	Medium	
2 (*b*)	Small		Round and oval	White netted	"	Very early	Short	
3 (*a*)	"		Oval	" "	"	" "	"	
4 (*a*)	Large and very fine		Round	" "	"	Late	Medium	

No. 99.								
1	Very large and vigorous	..	Kidney and round	Very white	Very white	Late	Long	
2	Very large and vigorous	..	Oval and round	,, ,,	,, ,,	,,	Short	
3	Long and weak	..	Oval	,, ,,	,, ,,	,,	Long	
4	Large and vigorous	White	Oval and round	,, ,,	,, ,,	,,	Medium	
5	Medium	..	,, ,,	,, ,,	,, ,,	,,	Short	
6	,,	..	Oval	,, ,,	White	,,	,,	
7	,,	..	Round	,, ,,	Very white	,,	,,	
8	Large	Very pale-lavender	Oval	Light-pink	Yellow	,,	Long	Flesh pink, creamy white
9	Small	..	Round and kidney	White	White	,,	Short	
10	,,	..	Oval	,,	,,	,,	,,	
11	,,	..	,,	,,	,,	Early	,,	
12	Medium	..	,,	,,	Cream	,,	,,	
13	,,	..	Oval and kidney	,,	Yellow	,,	,,	
14	Very large	Lavender	Oval	,,	Cream	Late	,,	
15	,, ,,	..	Round	,,	Yellow	Early	,,	
16	,, ,,	..	Oval and round	Yellow	,,	Late	Very long	Stringy growth
17	Medium	..	Oval	White	Cream	,,	Long	
18	Very large	..	Oval and kidney	,,	White	,,	Medium	
19	,, ,,	..	,, ,,	,,	,,	Early	,,	
20	Medium	..	Round	,,	,,	,,	,,	
21	Small	..	,,	,,	,,	,,	Short	
22	Medium	..	Oval and kidney	,,	,,	,,	,,	
23	Small	..	Round and kidney	,,	,,	Late	,,	
24	Very large	White	Oval	,,	,,	,,	Long	Stringy growth
25	Large	Lavender	Kidney	,,	,,	,,	,,	
26	Medium	..	Oval	,,	Cream	Early	Short and long	
27	Very large and vigorous	..	Oval and kidney	,,	White	Late	Medium to long	
28	Large	..	Kidney and round	,,	Cream	,,	Medium	
29	,,	..	Kidney and oval	,,	White	,,	Short	
30	,,	..	,, ,,	,,	Cream	,,	Long	
31	,,	..	Oval and round	,,	Yellow	,,	,,	
32	Medium	..	,, ,,	,,	,,	Medium	Short	

RESULTS OF EXPERIMENTS CARRIED OUT WITH DR. WILSON'S PEDIGREED POTATO SEED—*continued.*

No	Habit of Plant.	Colour of Flower.	Shape of Tuber.	Colour of Skin.	Colour of Flesh.	Time of Maturity	Character of Stolon	Remarks
No. 99—*continued.*								
33	Very large and robust	.. ..	Oval .. .	White ..	Pink ..	Late ..	Medium to long	Flesh pink
34	Medium	.. .	"	" ..	White .	" ..	Short	
35	Very large and robust	.. ..	"	" ..	Cream .	" ..	Medium to long	
36	Large	.. ..	"	Pale-pink ..	White ..	" .	Medium ..	Tubers large and numerous
No. 128.								
1	Small and wiry ..	.. .	Kidney and oval .	Pink ..	White ..	Very early ..	Short	
2	Long and spindly ..	.. ..	Round	Pink and white	" ..	Late ..	Medium	
3	Very small ..	. ..	Kidney .. .	White ..	" ..	Very early ..	"	
4	Long and spindly ..	.. ..	Oval and round .	" ..	" ..	Late ..	Long	
5	Small	White ..	Oval and kidney ..	" ..	" ..	Early ..	Short	
6	Large and spindly ..	.. ..	Kidney and oval .	White netted	" ..	Late ..	Medium	
7	Very large and spindly	White ..	Oval	" " ..	" ..	" ..	Long	
8	Very large and spindly	.. ..	Round and oval ..	" "	" ..	" ..	"	
9	Large .. .	.. ..	" . ..	White .	" ..	" ..	"	
10	" .. .	White ..	Kidney and oval ..	" .	Yellow ..	" ..	Short	
11	Medium	.. ..	Oval . .	" ..	" ..	Medium ..	"	
12	Very small .	..	" .. .	" .	White ..	Very late .	" ..	Tubers small—poor lot
13	Very large ..	.. .	" .	" .	" ..	" " .	" ..	Tubers very large
14	Large	White ..	" . .	"	" ..	" " .	" ..	Tubers fine and large
15	Medium	Pale-lavender	Round . ..	" ..	Yellow ..	Late ..	"	
16	Small and weak ..	.. ..	Oval .. .	" .	White ..	Early ..	"	
17	" " ..	.. ..	Oval and round ..	Yellow .	Yellow ..	Very early ..	"	

18	Very large	Lavender	Flat, oval, and round	White	Cream	Late	Medium to short	Very prolific
19	” ”		Oval	”	Yellow	”	Short	
20	” ”		Kidney and oval	”	White	”	”	
21	Large		Kidney	”	”	”	”	
22	Very large		Kidney and oval	”	Cream	”	Long	
23	Medium		Oval and round	”	White	Midseason	Medium	Tubers very numerous
24	Small		Kidney	”	”	Late	Short	Tubers few
25	”		”	”	Cream	Medium	”	” ”
26	Medium		Oval	”	Yellow	”	”	Tubers large
27	Large—very		”	”	Cream	Late	”	
28	Small		”	Yellow	”	Early	”	
29	Very large	Lavender	”	White	White	Midseason	”	
30	” ”		”	”	Yellow	Late	Medium	
31	Medium		Oval and kidney	”	Cream	”	Short	
32	”	White	Round	”	Yellow	”	”	
33	”		Kidney and oval	”	Cream	”	”	
34	”		Oval	”	Yellow	”	Long	Flesh bad colour
35	Small		Kidney	”	”	Early	Short	
36	Medium		Oval	”	”	Late	”	
36 (*a*)	”		”	”	Cream	Medium early	”	
37	Small		Oval and kidney	”	Yellow	Very early	”	
38	Very large		” ”	”	Cream	Late	Medium	
39	Medium		” ”	”	Yellow	Very early	Short	
40	”		Oval and round	”	”	Medium early	”	
41	Large		Oval	”	White	Late	”	
42	Very large		”	”	Yellow	”	Medium	
43	Small		Kidney and oval	”	”	Very early	Short	
44	”		Kidney	”	”	” ”	”	
No. 139.								
1	Small		Oval	Pink	White	Very early	Short	
2	”		Oval and kidney	White	”	Early	”	
3	”		Round	White netted	”	”	”	
4	”		Kidney and oval	” ”	Yellow	”	”	
5	”		” ”	” ”	Cream	Very early	”	
6	Large		Oval and round	White	White	Midseason	”	Large and numerous

RESULTS OF EXPERIMENTS CARRIED OUT WITH DR. WILSON'S PEDIGREED POTATO SEED—*continued*

No.	Habit of Plant	Colour of Flower.	Shape of Tuber	Colour of Skin	Colour of Flesh	Time of Maturity	Character of Stolon.	Remarks
No. 139—*continued.*								
7	Large		Kidney and oval	White	White	Midseason	Short	
8	Small		Kidney	,,	Cream	,,	,,	
9	Medium		Kidney and round	,,	,,	Very early	Very short	
10	,,		Oval	,,	,,	,, ,,	Short	
11	,,		Oval and kidney	,,	White	,, ,,	,,	
12	Very large		,, ,,	,,	,,	Midseason	,,	Large and numerous
13	Medium		Oval and round	,,	Cream	Early	,,	
14	Small		Oval	,,	,,	Very early	,,	
15	Large		Round	,,	White	Midseason	,,	
16	Very small		Kidney	,,	,,	Very early	,,	
17	Large		Oval	,,	Yellow	Midseason	,,	
18	Very large		Oval, round, and kidney	,,	Cream	Late	,,	Tubers numerous, some large
19	,, ,,		Oval and round	,,	White	Very late	Very long	
20	Small		Oval	,,	,,	Very early	Long	
21	,,		Round	,,	Yellow	,, ,,	Short	
22	,,		Kidney	,,	,,	,, ,,	,,	
23	Very large and robust	Lavender	Oval and round	,,	Cream	Late	Long	
24	Very large		Oval	,,	,,	,,	Medium to long	
25	Medium		,,	,,	Yellow	Medium	Short	
26	Very large and robust		,,	,,	White	Late	Medium	Large and numerous
27	,, ,, ,,		,,	,,	Cream	,,	Long	,, ,,
28	Medium		Oval and kidney	,,	White	Very late	,,	,, ,,
29	Very large and robust	Lavender	Oval	Pink	,,	,, ,,	Medium	Tubers pale-pink, nice appearance
30	Small		,,	White	Yellow	Early	Short	
31	,,		,,	,,	Cream	,,	,,	
32	Medium		Oval and kidney	,,	,,	Medium	,,	
33	Very small		Kidney	,,	Yellow	Very early	,,	
34	Large		Oval	,,	Cream	Late	,,	
35	Large		Oval and kidney	,,	,,	,,	,,	

No. 155								
1	Very large		Kidney and oval	Pink and white	Cream	Late	Short	Plants fine, stalks pale-green, some tubers very large
2	Small		Kidney	White	,,	,,	,,	
3	Very large		Round	Pink and white	,,	Very late	Short to medium	
4	Medium		Oval	,, ,,	,,	Midseason	Medium	
5	Medium—spreading		,,	White	,,	Late	Short	
6	Small		,,	,,	Yellow	,,	,,	
7	Very large		Oval and round	,,	,,	,,	,,	
8	Medium		Oval and kidney	,,	,,	,,	,,	
9	,,		Round	,,	,,	,,	,,	
10	Small		Kidney and oval	Pink to white	,,	Early	,,	
11	,,		Oval and round	White	Cream	,,	,,	
12	,,		Kidney and round	,,	,,	,,	,,	
13	,,		,, ,,	,,	,,	Late	Medium	
14	Very large		Oval and round	,,	,,	,,	Short to medium	Very large and numerous
15	,, ,,		,, ,,	Pink	,,	,,	Medium to long	Tubers numerous
16	Large		Oval	White and pink and white	White	,,	Long	Tubers small
17	,,		Kidney	White	Cream	Medium	Short	
18	Small		Oval and round	White netted	Yellow	Very early	,,	
19	Medium		Kidney and oval	White	Cream	Late	Medium to long	
20	Small		,, ,,	,,	,,	,,	Short	
21	,,		Kidney	,,	,,	,,	,,	
22	,,		Oval	,,	White	,,	,,	
23	Large		Oval and round	Pink	Cream	,,	,,	
No. 177.								
1	Very large		Oval	White	White	Late	Long	
2	Large and wiry	White	,,	,,	,,	,,	Short	
3	Small and compact		Kidney and oval	,,	,,	,,	,,	
4	Large and spindly		Round and oval	,,	,,	,,	,,	

RESULTS OF EXPERIMENTS CARRIED OUT WITH DR. WILSON'S PEDIGREED POTATO SEED—*continued.*

No.	Habit of Plant.	Colour of Flower	Shape of Tuber	Colour of Skin	Colour of Flesh	Time of Maturity	Character of Stolon	Remarks
No. 177—*continued.*								
5	Medium	.. ..	Oval	White ..	White ..	Late ..	Short	
6	,, ...	.. ..	,, ...	,, ..	Cream ..	,, .	Medium	
7	Very large ..	.. ..	,, ...	,, ..	White ..	Very early .	Short	
8	,, ,, ..	.. .	,, ...	,, ..	White and purple	Late ..	,,	
9	Large .. .	.. ..	,, ...	,, ..	White ..	,, ..	,,	
10	Medium	.. ..	,, ...	,, ..	,, ..	Very early ..	,,	
11	Very large ..	.. ..	,, . ..	,, .	,, ..	Late ..	Medium	
12	,, ,, ..	.. ..	Round . ..	,, ..	,, ..	,, ..	Short	
13	Large	.. ..	Kidney . .	Yellow ..	Yellow ..	,, ..	Medium ..	Tubers poor
14	Very small ..	. ..	Oval	,, ..	,, ..	Very early .	Short	,, ,,
15	Very large ..	.. ..	,, . .	,, ..	,, .	Late .	,,	

THE MILLING AND BAKING QUALITIES OF VICTORIAN WHEAT.

(*Continued from page 533.*)

By A. E. V. Richardson, M.A., B.Sc., Superintendent of Agriculture; P. R. Scott, Chemist for Agriculture; and F. G. B. Winslow, Departmental Miller.

Part II.

In the last article consideration was given to the more important properties of wheat and flour. It is now necessary to review briefly the actual methods followed in milling wheat and testing flour. Such a review, while of interest rather to those actually engaged in the milling and testing of grain than the general reader, is of importance, in order that the results of the various tests may be viewed in proper perspective.

The Method of Milling the Samples.

Before a parcel of wheat can be effectively and economically milled a certain amount of "conditioning" is necessary, *i.e.*, the wheat has to be tempered either by the use of water, heat, or both water and heat, until the skin of the berry becomes toughened and capable of ready separation from the floury endosperm. This process of conditioning is one of the most important operations in flour milling, more especially when a miller has to deal with wheats of different qualities. If by conditioning we merely meant that the wheat must have a certain percentage of water, then conditioning of wheat would be a simple operation. It is, however, a more complicated process than appears at first sight. For illustration, consider the practice of the English miller, who receives wheat from all over the world. In this case it is necessary to blend, condition, and mill at the same time widely divergent types of wheat, some of which are flinty in character, others soft, whilst some are so dirty that they cannot be milled without washing. Since the operator has to bring this mixture on to the roll in an even temper and mellowness, break down the wheat under the rolls in a free manner without cutting up the bran, and at the same time release the maximum amount of semolina and maintain an unvarying standard in the quality of flour, it will readily be seen that the conditioning of wheat is a most important operation.

The practice of washing wheat in cleaning and conditioning is not generally followed in Australia for two reasons—(1) the average Australian wheat is soft, free from dirt, and the natural colour of the flour is the finest in the world; (2) Australian wheats assimilate moisture more rapidly than other wheats, and if allowed to stay in the water for any length of time they become water-logged and useless for flour making. The use of live steam just before the wheat enters the breaks has the effect of toughening the bran and helps to get all the bran from the endosperm without injuring the quality of the flour.

There can be no doubt that a little moisture added to the endosperm of the berry during the process of conditioning, besides bringing a

slight profit to the miller, has the effect of stimulating the enzymes and promotes some action amongst the constituents of the flour that has the effect of improving it. If the wheat is then milled at the proper time a sweet flavour is transmitted to the flour. If, however, the wheat is left too long before being milled, the good effects are lost and a secondary fermentation is set up which is detrimental to the flavour of the flour; also, too much moisture will be found in the endosperm. Consequently there will be a lot of highly-coloured break flour, but comparatively few high-class middlings.

With the small quantity and various types of wheat taken for a test in the experimental mill it would not be possible to use heat in conditioning with any hope of uniformity in the quality of the flour from

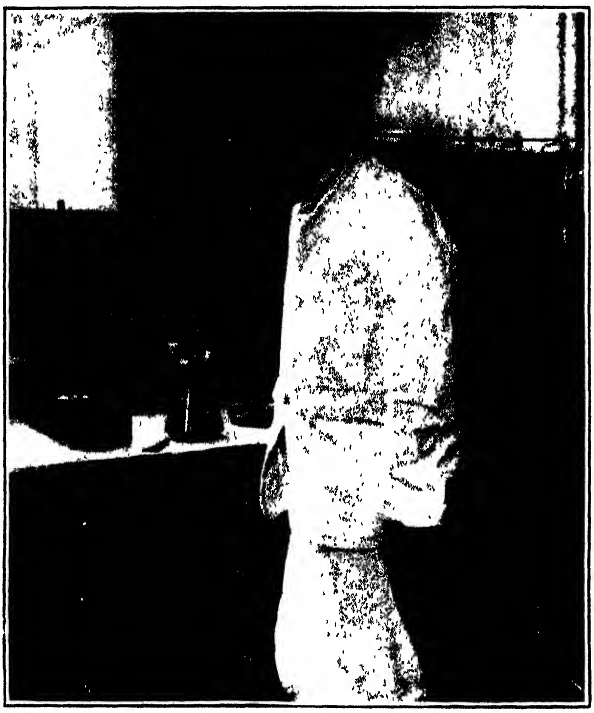


Fig. 7.—Chondrometer for testing the bushel weight.

the same variety milled at different times. The method followed, allowing for the hardness or otherwise of the berry, is to measure in a burette the water required, and then allow the wheat to lie in the conditioning trays until the wheat is ready for the break. Durum wheats require different treatment from the soft wheat, as they are of a hard, flinty character, absorbing water very slowly, and will stand severe treatment. The method followed in conditioning Durum wheat is to add the water required at three intervals during twenty-four hours.

To test the milling and baking qualities of the different varieties of wheat grown at the Experimental Farms, an experimental roller flour mill, made by Henry Simon and Company, driven by a three horse-power electric motor, an electric oven fitted with six electric heaters,

a thermometer with a high range of temperature, a proving cabinet fitted with eight electric globes and a thermometer, so that the heat could be regulated, was installed at the Agricultural Chemist's laboratory.

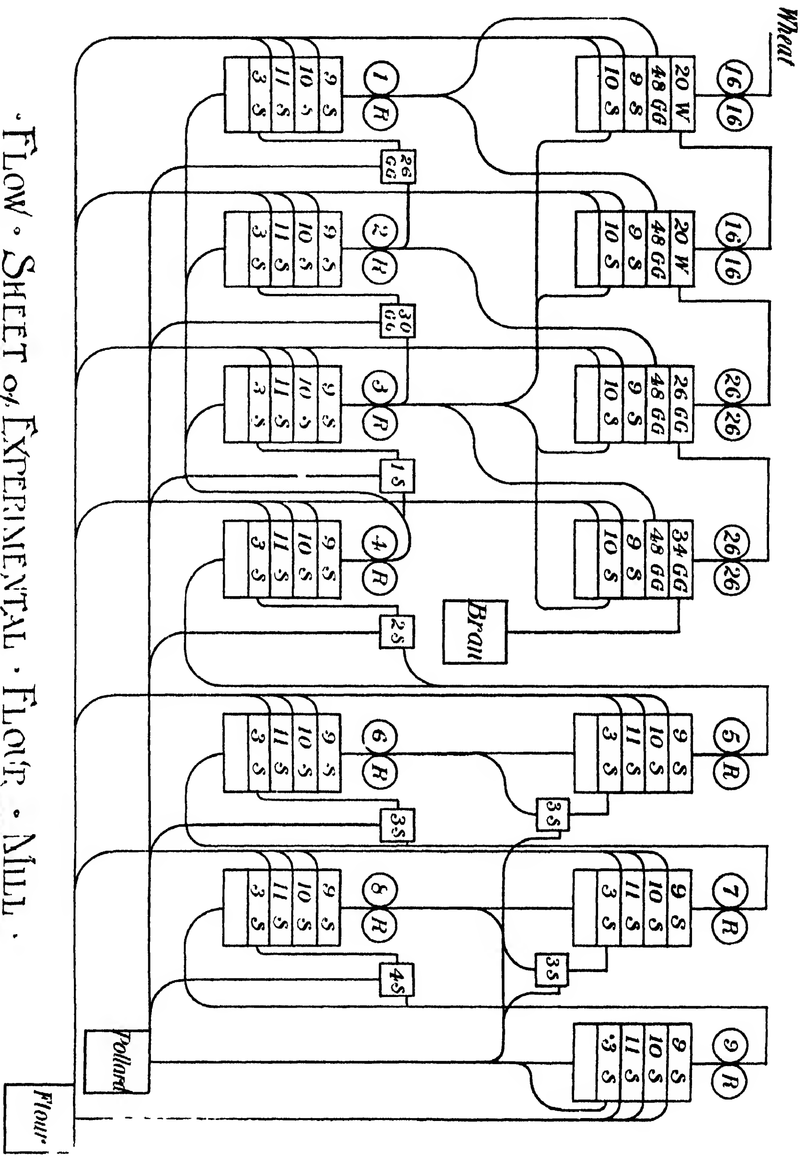
The flour mill consists of two roller mills, one for the breaks, with two sets of corrugated rolls, whilst the other, which is fitted with smooth rolls, is used for the reduction. One set of break rolls has sixteen corrugations to the inch, the other set twenty-six corrugations. The mill has two plan sifters, each fitted with four sieves. The roller mills and plan sifters are so constructed that as each sample is milled they can be taken to pieces, thoroughly cleaned, and all the products recovered; a set of hand sieves being used as accessories for extracting the offal.

One thousand grams of wheat (about 2¼ lbs.) are taken for each test. Working on such a small quantity, it is not possible to use purifiers with any hope of successful separation of the pure middlings and the by-products; these must be separated at every possible opportunity by means of hand sieves of different meshes, and easy reductions. The flour so obtained will compare favorably with commercial flour.

The corrugated rolls grind dull to sharp, and have a differential of 2½ to 1. The fast roll runs at 400 revolutions per minute, and the slow roll at 160 revolutions per minute. The corrugations on the rolls are cut at a slight angle, and have a sharp saw-tooth edge. This prevents the rolls from interlocking should they be set too close, and also assists the shearing action at work. The rolls run at different speeds, which accelerates the separation of the bran and prevents the kernel from being flattened. The smooth rolls have a differential of 1¼ to 1; the fast roll runs at 400 revolutions per minute and the slow roll at 325 per minute.

As all scalping, grading, and dressing is done on the two plan sifters, the principle on which they work will now be explained. The plan sifter consists of four airtight sieves placed on top of one another and bolted down. The plan sifter is run at 120 revolutions per minute, and the motion rotary. The grind is passed from the rolls to the first sieve by an airtight sleeve, and by means of slats 2 inches apart, passes over the whole surface of the sieve. It then falls on to the second sieve. This process follows on automatically until the grind has been graded and sent to its proper destination.

When the wheat is cleaned and conditioned it is ready for the breaks. The feed on the rolls is so regulated that the stock under operation is touched by both rolls at the point of contact, care being taken that the berry is not crushed between one roll and the cushion of another berry. In order to obtain a proper finish on the break rolls, care must be exercised to make the first and second breaks do as much as possible without overdoing it. If this is not done, the latter breaks are overworked, and a good finish of the bran is impossible, as there will be a mass of fine mushy stock that will defy separation in a satisfactory manner. Summed up briefly, there are three main objects in breaking down the wheat—firstly, to make as large a percentage of sharp granular semolina as possible at each break; secondly, to leave the bran as clean and broad as possible; thirdly, to make as little break flour as possible.



Flow · Sheet of Experimental · Flour · Mill ·

Fig. 8.

The flow sheet on this page shows the process that is followed in milling samples, and the following is a description of the various stages in milling the wheat:—

1st *Break.*—The rolls have 16 corrugations to the inch, and are set to crack the berry down the crease, the chop passes to the plan sifter and is scalped on 20 wire, the tailings which pass over the 20 wire are sent to the second break. The throughs are dressed over 48 grit gauze, the coarse semolina that tails over is sent to the first reduction, the throughs are dressed over 9 and 10 silk, the fine semolina that tails over is sent to the third reduction, and the throughs break flour to the flour bin.

2nd Break.—The feed for this break is the tailings from 20 wire of the first break, as the best quality middlings are made at this break, averaging 30 to 40 per cent. of the total, the rolls are set with the object of making as much as possible at this stage, and as at no other break is the quality so good, the opportunity must not be missed to make as much middlings as possible. The rolls are, therefore set with this object in view. The chop is scalped over 20 wire, the tailings that pass over are sent to the third break, the throughs dressed on 48 grit gauze, the coarse semolina that tails over is sent to the first reduction, the throughs dressed over 9 and 10 silk, the fine semolina that tails over is sent to the third reduction, and the throughs break flour to the flour bin.

3rd Break.—For this break the finer set of rolls, 26 corrugations to the inch, are placed in the frame, the rolls are set to shape the bran, not to scrape or smash the semolina into flour, as this would increase the percentage of break flour, which is not a desirable feature in the gradual reduction process. The chop is scalped on 26 grit gauze, the tailings are sent to the fourth break, the throughs dressed on 48 grit gauze, the semolina that tails over sent to the second reduction, the throughs dressed on 9 and 10 silk, the fine semolina that tails over sent to the third reduction, and the throughs break flour to the flour bin.

4th Break.—The feed for this break is the tailings from the third break. The rolls are set so that the bran is just clean, with a slight imprint of the corrugations on it, but not too close to chip it. Too close setting of the rolls here will tear the bran into strips, and also press a yellow dye out of the bran which is detrimental to the colour of the flour. The chop is scalped and dusted over 34 grit gauze, and the tailings are sent to the bran bin, the throughs are dressed over 48 grit gauze, the semolina that tails over sent to the third reduction, the throughs dressed over 9 and 10 silk, the semolina that tails over is also sent to the third reduction, and the throughs break flour to the flour bin. This finishes the breaks, the stock is now about 10 per cent. flour, 20 per cent. bran, and 70 per cent. semolina.

The Reductions.—The treatment the wheat received on the corrugated rolls is called the break system. The second process on the smooth rolls is called reductions. It is essential, therefore, that a thin regular stream is fed on the full length of the roll, the pressure varying according to the size and quality of the stock, flaking carefully avoided, and all stock fed to the rolls should be kept as much alike as possible in quantity, quality, and size.

Many millers are putting in finely corrugated rolls (about 100 to the inch) for the first reductions, which they claim keep the flour cooler, more granular, avoid flaking, and add to the strength of the flour.

Owing to the gentle treatment of stock received in the experimental mill and dressing through 9, 10, and 11 silks, the flour is very granular, and providing other things being equal, flour that has been coarsely dressed over 10 and 11 silks is better for baking purposes than one finely dressed. Bread made from the latter will not be so bold or good looking as that made from coarse flour. The finer flour will, however, be easier to knead and take water quicker. In grinding, care must be taken to avoid flaking. If flakes are formed, the starch cells are damaged, the strength and quality of the flour lowered, and it is impossible to obtain a clean finish on the last reduction. The object is to obtain as high a percentage of flour as possible without getting any of the pollard in the flour. If the middlings are treated harshly all the flour will certainly be extracted, together with a good portion of the pollard. The feed for the reductions is the endosperm of the wheat, and is composed of flour, middlings, and dunst. Dunst is a lighter product than middlings, and, looked at critically, appears to be part of the berry which has encircled the starch and forms the walls of aleurone cells. It is not so compact as the inner portion (middlings) just mentioned, and has a tendency when under operation to flatten out. In reality this part gives first notice of excessive pressure by flaking, and acts as a kind of cushion to protect the more valuable middlings. The object of reduction, summed up, means when and where to apply or relieve the pressure, and so to work the rolls that nothing is done to injure the baking

quality of the flour, and that all the flour in the stock is obtained in as pure a state as possible and free from impurities.

1st Reduction.—The coarse semolina from the first and second breaks is sent through this roll. The feed should look round, clean cut, and very sharp. The rolls on the second and third reductions are set to make as much fine middlings as possible for the fourth reduction. The grind is dressed on 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings that tail over dressed on 3 silk, the tails hand-sieved on 26 grit gauze, the throughs sent to the second reduction, the germ and small particles of bran that are clinging to the endosperm sent to the pollard bin.

2nd Reduction.—The feed for this reduction is the coarse middlings from the first reduction and the third break. The rolls are set closer, the grind is dressed over 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings dressed on 3 silk, the throughs sent to the fourth reduction, the tailings hand-sieved on 26 grit gauze, the throughs sent to the third reduction, and the tailings to the pollard bin.

3rd Reduction.—The feed for this reduction are the fine middlings from the first, second, third, and fourth breaks, together with the middlings from the second reduction and the coarse middlings from the fourth break. The rolls are set closer, the grind dressed over 3 silk, the throughs sent to the fourth reduction, the tailings hand-sieved on 1 silk, the throughs sent to the fourth reduction and the tailings to the pollard bin (about 80 per cent. of the pollard has been extracted on the three reductions).

4th Reduction.—The feed for this reduction are the fine middlings from the first, second, and third reductions, and the throughs of 1 silk. The rolls are set to make as much flour as possible. The first three reductions had been set to make as much fine middlings as possible for this reduction The opportunity for a large release of flour must not be lost here, as at no other stage of the reductions is the colour or quality of the flour so good, and the stock will stand harsher treatment here, better than anywhere else. The grind is dressed on 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings dressed on 3 silk, the throughs sent to the fifth reduction, the tailings hand-sieved on 2 silk, the throughs sent to the fifth reduction, and the tailings to the pollard bin.

5th Reduction.—The feed for this reduction are the middlings from the fourth reduction. The rolls are set closer, the grind dressed over 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings dressed on 3 silk, the throughs sent to the sixth reduction, the tailings hand sieved on 3 silk, the throughs sent to the sixth reduction, and the tailings to the pollard bin.

6th Reduction.—The feed for this reduction is the middlings from the 5th reduction. The stock is still sharp and granular, the rolls are set close, the grind dressed over 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings dressed on 3 silk, the throughs sent to the seventh reduction, the tailings hand-sieved on 3 silk, the throughs sent to the seventh reduction, and the tailings to the pollard bin.

7th Reduction.—The feed for this reduction is the middlings from the sixth reduction. The rolls are set so that if there are any small particles of bran or germ in the stock they are flattened out and sent to the pollard bin. The grind is dressed on 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings dressed over 3 silk, the tailings hand-sieved on 3 silk, the throughs sent to the eighth reduction, and the tailings to the pollard bin.

8th Reduction.—The feed for this reduction is the middlings from the seventh reduction. The stock is light and feathery, and requires gentle treatment to release the flour. The grind is dressed over 9, 10, and 11 silks, the throughs sent to the flour bin, the middlings dressed on 3 silk, the throughs sent to the ninth reduction, the tailings hand-sieved on 4 silk, the throughs sent to the ninth reduction, and the tailings to the pollard bin.

9th Reduction.—The feed for this reduction is the middlings from the eighth reduction. The condition of the stock is generally very poor, and it has to be taken into account when setting the rolls. The grind is dressed over 9, 10, and 11 silk, the throughs sent to the flour bin and the tailings to the pollard bin.

Methods of Testing the Samples of Flour.

As already indicated in Article I., the commercial value of a flour is determined mainly by its colour, strength, and gluten content. Certain conventional tests are applied to the flour to determine these points. Other tests of importance, especially in making comparisons of various flours, are the moisture and protein content, acidity, and, in special cases, the gliadin and soluble nitrogen content of the flour. Apart from determination of crude protein, which necessitates special apparatus and careful manipulation, the other tests used are readily executed, and can be performed after a little practice. Pre-eminence is accorded to the determination of the crude protein, since the protein content, in a large measure, determines the quality of the flour, especially from a nutritive point of view.

Protein Content.

The protein content is usually determined by the well-known Kjeldahl process. In the case of wheats, five grams are taken, and for flour one gram. The percentage of nitrogen, as determined by analysis, is multiplied by 6.25.

Colour.

A simple method of testing the colour has already been described. (*Journal of Agriculture, Victoria*, September, 1913, p. 530.)

Water Absorption Capacity.

The amount of water that a flour will hold on baking and yield a well-piled loaf is one of the most important factors in determining the value of a flour from a baker's point of view. The test as outlined is designed to obtain directly the number of quarts of water required to add to a 200-lb. sack of flour to make a dough of required consistency suitable for baking into bread. This operation depends largely upon the judgment of the individual, and can only be considered satisfactory after some lengthy experience correlated with actual baking tests on the flours. The *modus operandi* consists in weighing out 40 grams of flour, and placing in a porcelain basin and adding from a burette 20 centimetres of water, mixing well by means of a spatula into a paste. Then remove the paste from the basin and continue adding more water—a few drops at a time—kneading the ball of paste with the fingers until a dough is obtained of such consistency as will enable the operator to draw the dough out into long threads without breaking and remove it from the hands without

sticking thereto. The number of c.c.s. of water required to attain this object multiplied by two will give the number of quarts of water necessary to add to a 200-lb. sack of flour.

Wet Gluten.

Wheat when mixed with water possesses the property of forming a material which can be readily kneaded into any shape, and which on further washing with water, leaves a sticky adhesive mass, known as gluten. To determine the quantity of this residue in a flour 10 grams are weighed out into a porcelain basin and about 8 c.c.s. of water are added, the whole well kneaded together into a round ball of dough, allow this to stand for one hour, then hold between the fingers of the right hand under a stream of running water over a sieve of bolting gauze, keep working the ball continuously until no more starch remains intermixed with the gluten, any particles of gluten that may have been separated and washed away along with the starch can now be collected on the sieve and added to the main piece, which now should be worked sufficiently well to remove any adhering drops of water before weighing.

Dry Gluten.

After weighing, the wet gluten is placed in a water oven and kept there until on repeated weighing the weight remains constant.

VICTORIAN F.A.Q. WHEAT.

In order to review the milling and baking qualities of various types of Victorian-grown wheat in proper perspective, some discussion of the f.a.q. sample is necessary. The greater part of the Victorian wheat crop is exported each year, and practically the whole harvest is bought by reference to a definite standard of quality—the fair average quality, or f.a.q. standard, annually fixed by the Corn Trade Section of the Chamber of Commerce.

A similar practice obtains in other wheat-exporting States of the Commonwealth. Now, this f.a.q. standard is a composite sample prepared by mixing a large number of representative samples from the principal wheat-growing districts of the State in parts proportional to the production of each district. Provided that the number of samples obtained is large, that they are thoroughly representative, and that they are mixed in parts proportional to the production of the various wheat districts, the sample struck should be a fair average standard of the harvest of the State. The Corn Trade Section claims that the sample struck is a true average of the whole of the wheat of the State.

Assuming this claim to be true, let us consider the constitution and properties of the f.a.q. sample for 1912-13. For this purpose 2,000 grams of Victorian f.a.q. wheat (1912-13), obtained from the Chamber of Commerce, were carefully examined and all impurities removed by hand.

A similar procedure was followed with a similar amount of f.a.q. wheat obtained from the Chambers of Commerce of South Australia and New South Wales. The results of the test were as follows:—

TABLE I.

Showing Amount of Impurities in f.a.q. Standard Wheat of Victoria, New South Wales, and South Australia.

(Per 1,000 grams.)

	Victoria	South Australia	New South Wales
Oats	0·91	0·42	0·28
Wild Oats	1·96	0·24	0·14
Barley and Drake . ..	1·66	3·00	0·27
Straw	0·11	0·02	0·02
Chaff	1·55	2·02	0·86
White Heads .. .	0·62	0·43	0·31
Weed Seeds .. .	0·22	0·21	0.07
Bunt	0·31	0·56	0·18
Rubbish	0·15	0·86	0·58
Total ..	7·43	7·76	3·71
	(·74 %	=0·77%	0·37%

Chaff. Wild Oats. White Heads. Barley and Drake. Oats. Weed Seeds. Bunt. Straw. Rubbish.

Fig. 9.—Rubbish and weeds in Victorian f.a.q. sample of wheat.

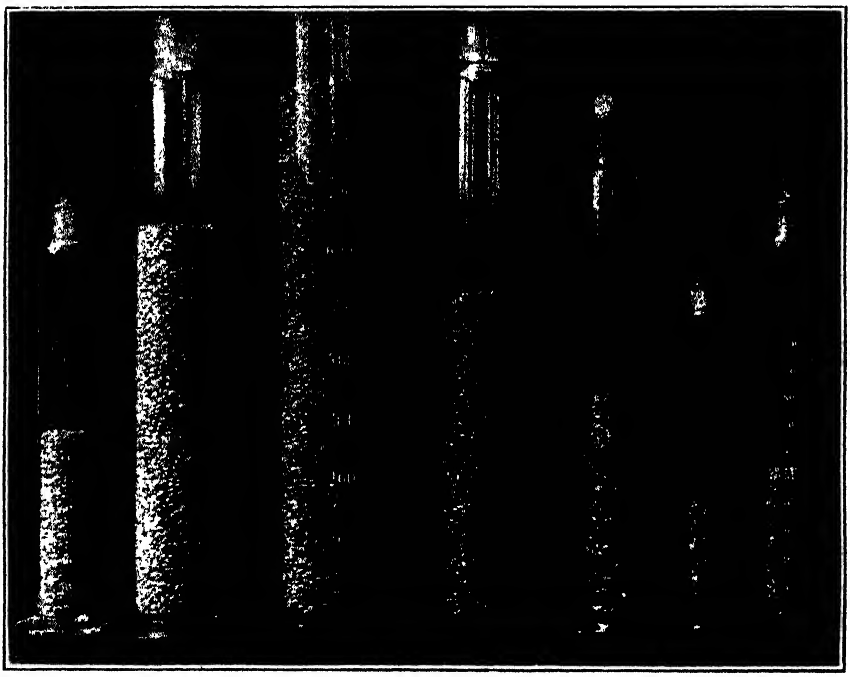
(*a*) Though the amount of impurities may not appear to be high, still, the amount is considerable if the total amount of wheat exported is taken into consideration. Assuming

that the export from these three States averages over a period of years, say, 20,000,000 bushels each, the amount of impurities exported with the wheat crops would exceed 10,000 tons per annum, the freight of which would amount to £15,000.

(*b*) It will be noted that the f.a.q. samples from every State contain bunt, a regrettable feature in view of the fact that the ravages of this fungus pest can be controlled by the farmer by the simple process of pickling.

(*c*) The New South Wales sample is freer from impurities than the other States—containing one-half of the amount present in the Victorian and South Australian samples.

(*d*) The chief impurity in the Victorian sample is wild oats, in the South Australian barley and drake, in the New South Wales sample chaff and rubbish.



3·25 mm 3·0 mm 2·75 mm 2·50 mm 2·25 mm 2·00 mm Screenings

Fig. 10.—Grades of Victorian wheat.

If the f.a.q. sample is submitted to careful grading (after the removal of impurities) by means of specially-constructed hand sieves, interesting results are obtained. The meshes of the sieve best suited for this process of grading are respectively 3.25 millimetres, 3.00, 2.75, 2.50, 2.25, and 2 mm.

Table II., on the next page, indicates the results obtained by grading the wheats with these sieves.

From this table it will be seen that the Victorian sample contains a much larger proportion of plump grain than either of the other

two samples. Thus, no less than 70.8 per cent. of the Victorian sample was retained by a sieve with a mesh of 2.75 mm., whilst 62.2 per cent. was retained in the South Australian sample, and only 59.5 per cent. in the case of New South Wales wheat.

The grades of the Victorian sample are illustrated in Fig. 10.

The average amount of screenings present in the three f.a.q. samples is approximately 2.1 per cent. On the basis of a combined export of 60,000,000 bushels from these three States, the amount of screenings exported—comprising almost wholly cracked and shrivelled grain—would equal 33,750 tons on which the freight to London is 30s. per ton. There can be little doubt that the elimination of these screenings and impurities from our exported wheat parcels, either as a result of more efficient preparation on the farm or by the use of grading machinery in a system of State bulk handling, would further enhance the quality and value of Australian wheats on the world's markets, which enhancement must ultimately react in favour of the wheat-grower.

TABLE II.

Showing Amount of Grain of various Grades in 1,000 grams of Cleaned f.a.q. Wheat.

Dimensions of Sieve	Victoria	South Australia.	New South Wales
3·25	34	24	32
3·00	230	164	124
2·75	444	434	439
2·50	195	218	283
2·25	60	116	90
2·00	12	25	14
Screenings.	25	19	18

The three f.a.q. samples were next compared with one another in respect to their chemical composition, and milling and baking qualities, so that the comparisons could ultimately be made of the f.a.q. samples with the different varieties of wheat under cultivation at the State farms. The following table gives these particulars:—

TABLE III.

Showing the Milling Qualities of f.a.q. Wheats.

Variety.	Bushel Weight lbs.	Break Flour.	Percentage of Mill Products. Flour.	Bran.	Pollard.	Color of Flour.	Remarks.
		Per cent.					
New South Wales f.a.q.	62¼	8·3	69·91	19·76	10·32	Good	Bran broad, flour nice bloom, good appearance, lively
Victorian f.a.q. ..	63	8·25	70·92	18·88	10·18	Good	Bran broad, flour nice bloom, good appearance, lively
South Australian f.a.q.	62	7·6	70·12	19·68	10·19	Good	Bran thin, broad flour, nice bloom and appearance lively

The flours were then tested for moisture, protein, wet and dry gluten, and strength (water absorption capacity) with the following results:—

TABLE IV.

Showing Results of Tests of Flour of f.a.q. Samples.

	Moisture.	Protein	Gluten Wet	Gluten Dry	Water Absorption	Gluten Ratio.
	%	%	%	%	%	%
New South Wales f.a.q.	13·60	11·56	30·17	9·34	45·4	1–3·23
Victoria f.a.q. ..	13·97	11·06	25·97	7·81	44·8	1–3 32
South Australia f.a q.	13·58	10·31	29·31	8·78	44·8	1 3·33

WHEAT AND FLOUR PROTEIN CONTENT.

		Wheat. per cent. of protein		Flour per cent. of protein
New South Wales	..	12·69	..	11·56
Victoria ..	..	10·68	..	10·06
South Australia	..	12·15	..	10·31

The ratio between the total nitrogen and the soluble nitrogen has been advanced as affording some indication as to the quality of the flour. This determination is carried out by taking 10 grams of flour and shaking in a flask with 150 c.c.s. of water until a thorough mixture is obtained. The flask and its contents are then heated in a boiling water bath for at least five minutes, shaking frequently meanwhile, then cooling the solution and making up to 200 c.c.s. filtered, and 50 c.c.s. of the filtrate taken, and the nitrogen determined by Kjeldahl process in the usual way.

The ratio betwen the total nitrogen and the soluble nitrogen in twenty typical samples of good flours being 5.72—1, and in the case of seven samples of inferior quality being 1.85—1.

The f.a.q. samples were treated as above, and gave the following results:—

TABLE V.

——	Total Nitrogen.	Soluble Nitrogen.	Soluble. Total
	%	%	%
New South Wales ..	1·85	0·460	4.02—1
Victoria	1·61	0·409	3·94—1
South Australia.. .	1·65	0·386	4·27—1

* Ann. Falsificat. 1913 (6).

Finally the flours were made into dough and baked in the electric baking oven. This gives a reliable test of the quality of the flour, the criterion being the amount of well-piled bread of good texture and colour produced per sack of flour. The method used in baking these flours was as follows:—340 grams of flour were taken, 6 grams of compressed yeast, 6 grams sugar, 5 grams salt, and water equivalent to the water absorption previously determined. All utensils and apparatus are kept at 90 deg. F. Each dough is given the same treatment in kneading, proving, and the length of time in oven. The flour is mixed and aerated by a hand mixer. The yeast is first added, mixed in a small quantity of water, and the sugar and salt in the remainder of the required water. The whole of the ingredients are mixed with the flour and kneaded together for fifteen minutes to make a satisfactory dough;

Fig. 11.—Electric baking oven.

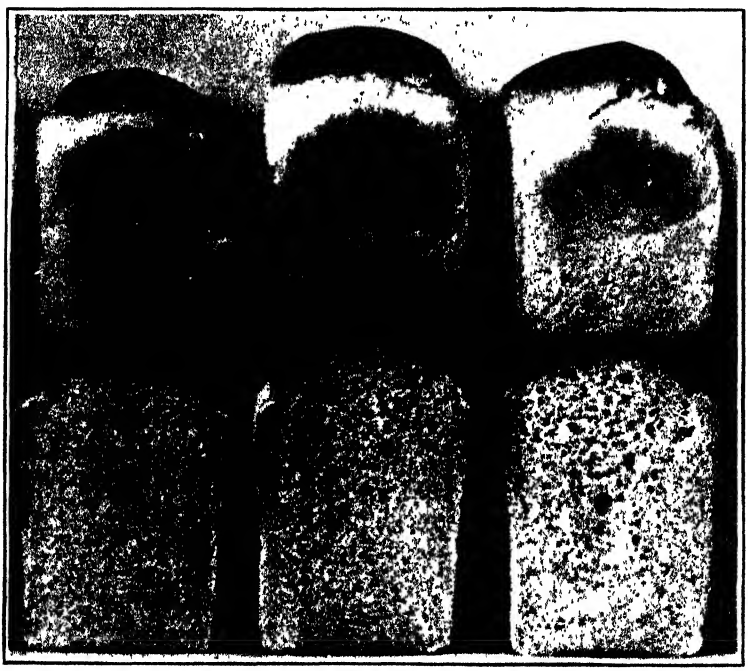
the dough is then placed in the proving cabinet. The process of proving entails three different operations:—the dough is first allowed to remain in the cabinet for sixty minutes; it is then knocked back and allowed to prove for another thirty minutes; it is then taken out and moulded, placed in a tin, put back into the cabinet, and allowed to prove until it appears to be in a suitable condition for removal to the baking oven.

The tin and its contents are then placed in the oven and baked for twenty minutes. The temperature of the proving cabinet is maintained at 90 deg., and the oven at 420 deg. F., by the aid of eight separate switches. The loaves are weighed one hour after, and twenty-four hours after leaving the oven. The volume of the loaf is measured by displacement with linseed. After twenty-four hours, the loaves are cut, and the colour and texture decided. In deciding texture, account is

taken of the crust, crumb, and pile. The crust should present fine even pores without roughness or cracks, the crumb should be uniform throughout as regards evenness and size of pores, and the body should be moist, friable, and elastic.

TABLE VI.—BAKING TESTS.

Variety of Flour.	Grams weight after 1 hour.	Grams weight after 24 hours	Volume in cc.	Texture	Color	Water absorbed in dough	Remarks
New South Wales f.a.q.	472·5	463	1,580	Good	Good	192·1	Excellent loaf, rose well in oven
South Austr li n f.a.q.	474	464·5	1,415	Good	Good	191·2	Rose well in oven, good crust and appearance of loaf
Victorian f.a.q...	475·5	466	1,545	Good	Good	187	Excellent loaf, rose well in oven



S.A. 41 N.S.W. 42 V. 43

Fig. 12.—Three sets of loaves, Victorian, New South Wales, South Australian f.a.q. wheats.

The New South Wales sample was intermediate in bushel weight, gave slightly less flour than either of the other wheats, but the quality of the flour was superior to either Victorian or South Australian. The protein content of both wheat and flour were comparatively high, the gluten content and water absorption higher than either of the other

samples. The flour on baking gave an excellent loaf of good texture and colour, and the volume and pile were very good.

The Victorian sample gave the highest bushel weight, and yielded the greatest quantity of flour, but the flour contained slightly more moisture than the other samples. It had the lowest protein and gluten content and the lowest ratio of soluble nitrogen to total nitrogen. On the other hand, the yield of bread was good, and the volume and texture excellent.

The South Australian sample was lowest in bushel weight, intermediate in yield of flour, moisture, protein, and gluten content. The dough did not rise to the same extent as either Victorian or New South Wales, and the volume and pile of the loaf was slightly poorer than either of the other flours.

(To be continued.)

CITRUS CULTURE IN VICTORIA.

(Continued from page 541.)

PART VI.—MANURING.

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

The four essential constituents of the soil necessary to the productiveness and general fertility of the citrus orchard are lime, nitrogen, phosphoric acid, and potash. Lime is present in most plants, and no commonly cultivated vegetable is found entirely devoid of this alkaline earth, and it is reasonable to deduce that it is an essential inorganic constituent of plants. Most of our citrus areas contain lime to a greater or less extent, but not always in a readily available form to benefit the plant. The writer, in referring to this in the *Mildura Cultivator*, of 8th September, 1900, said then:—"It seems almost paradoxical to say 'use lime in your soil,' for although your settlement is full of limestone, yet it is not in that readily available form which is so necessary to the tree." It is often necessary to apply lime to the soil. The most important office of lime is that of decomposing insoluble silicates, rendering certain of their constituents soluble, by liberating the alkalies present—viz., potash and soda—as soluble silicates, and thus available as inorganic plant food. Lime is most beneficial in clay soils, breaking up such by union of certain of its constituents with the lime, and liberating the alkalies present in the clay in a soluble form.

Lime is also an advantage in causing the more rapid decomposition of any excess of organic matters in soils, during the decomposition of which certain acids are liberated, which are injurious to plants. Lime neutralises and combines with these, and thus prevents injurious effects. Lime also acts on many injurious inorganic constituents in the soil, decomposes them, and transforms them into useful ingredients. Lime, if mixed with any manure which contains salts of ammonia, possesses a

greater affinity for the acids in combination with the ammonia than the volatile alkali itself has, the result is production of salts of lime, and the ammonia being liberated in gaseous condition is dissipated and lost. Gypsum (sulphate of lime) is also useful to correct black alkali (sodium carbonate) in the soil, as it renders the soluble humus and phosphates insoluble, but not unavailable as plant food, and retains them in the soil after the injurious alkalies have been washed out. The deduction is that lime corrects acidity and improves the mechanical condition of the soil, liberates plant food, especially phosphates and potash, decomposes organic matter, promotes nitrification and bacterial activity, and increases soil fertility.

In citrus culture lime is an essential both for the health of the tree, and the delicacy of the fruit. It should be applied in the autumn or early spring, after being properly air slaked in heaps throughout the orchard, then broadcasted thoroughly, and ploughed in. The quantity to be applied should be ascertained by a soil analysis from the Chemist for Agriculture, a most necessary proceeding every few years, to know exactly the condition of the soil to a depth of 2 feet, physically and chemically.

REPORT ON SAMPLES OF SOILS SUBMITTED BY MR. S. A. COCK, BENDIGO.

— —	No. 1	No. 2	No. 3.	No. 4	No. 5	Block 67, Bamawm	
	McDonald, Koondrook Soil to 2 feet	Leaf loam from Koondrook	Merbein, Mildura Soil to 15 inches.	Merbein, Mildura. Soil to 2 feet	Echuca, Soil to 2 feet	C.1. Soil, 0 inches to 12 inches.	C.2 Soil, 12 inches to 24 inches
Chemical Analysis.	%	%	%	%	%	%	%
Moisture	7·70	11·74	3·23	1·76	3·03	0·70	2·88
Loss on ignition	5·02	21·07	3·35	2·44	4·05	2·29	3·63
Nitrogen	0·078	0·579	0·058	0·014	0·035	0·042	0·028
Phosphoric acid	0·055	0·117	0·032	0·032	0·046	0·024	0·027
Potash	0·196	0·244	0·376	0·218	0·262	0·089	0·292
Lime	0·200	0·680	0·556	0·848	0·321	0·174	0·214
Magnesia	0·267	0·362	0·335	0·233	0·411	0·189	0·318
Chlorine	0·002	0·006	0·008	0·002	0·005	0·004	0·006
Re-action	Acid	Neutral	Neutral	Slightly alkaline	Slightly acid	Slightly acid	Fairly acid
Mechanical Analysis.	%	%	%	%	%	%	%
Very coarse sand	Nil	Nil	1·01	Nil	0·18	Nil	
Coarse sand	0·95	0·48	5·57	1·98	0·75	0·65	
Medium sand	0·63	0·75	12·69	8·58	0·81	1·05	54·00
Fine sand	3·53	6·88	38·14	59·41	11·01	34·44	
Very fine sand	26·57	19·51	18·41	15·82	25·48	38·60	
Silt	4·24	5·59	1·29	0·99	7·82	6·44	10·85
Fine silt	9·11	8·14	1·15	0·61	10·64	3·50	
Clay	42·25	25·84	15·16	8·41	36·23	12·33	28·64

The soils of Mildura can, to a large extent, be taken as typical of the pine ridge country of the Mallee. The Murray soils at Echuca and Koondrook as typical of the Murray fringe, and Bamawm as typical of Tongala and Rochester.

Plate 23 represents five-year-old Washington navel grown on the soil from which Sample No. 1 was taken. The soil has been enriched by a dressing of one load of leaf loam to each tree when planted. Sample No. 2 is extremely rich in all necessary plant food. Mr. Nelson,

of Gannawarra, at the writer's suggestion, nine years ago dressed his trees with a similar loam, and the results have been highly satisfactory; both he and Mr. McDonald state that one application of a load per tree every six years is sufficient for all the requirements of the tree. The orange and lemon trees in these orchards are a lustrous green colour, the fruit of excellent texture, with thin deep-coloured rind, the Washington navels for uniformity of size and prolific bearing hard to excel. Every grower will not be able to procure leaf loam for his trees, but wherever obtainable, it is the finest dressing that can be applied, adding both bulk and manure to the soil. The analysis will act as a guide to the grower in selecting suitable manures for his orchard. Sample No. 1 was virgin soil, taken outside the line of orchard trees. Samples Nos. 3, 4, Merbein, Mildura soils, are deficient in nitrogen and phosphoric acid. These soils, as do also Samples C1, C2, Block 67, Bamawm, which is the suitable citrus soil typical of Rochester and Tongala district, require green manuring; and it is advisable to prepare the ground before planting by sowing a crop of peas or tares along with a dressing in the autumn of blood, bone, and super., ½ cwt. of each to the acre, and plough the green crop under in August, and harrow it down before planting. These soils require humus; and manuring, as suggested, is beneficial, not only to the trees, but renders the soil more suited to irrigation, by preventing the hard caking condition so manifest under irrigation culture. At Nyah, and in many of our northern districts, where similar soils are worked, this practice of green manuring as a preparation of the soil for orchard trees, is becoming more general every year.

Sample No. 5, Echuca soil, is deficient in nitrogen and phosphoric acid; it has been for many years in cultivation without manuring, and requires similar treatent by green manuring (if leaf loam be not obtainable). It is a similar soil to Sample No. 1, and produces excellent oranges and lemons.

Plates 12, 25, 26, represent 12 years' old trees grown on similar soil to Sample C1, C2, Bamawm, and it will be observed that green manuring is carried on in this orchard by allowing a crop of natural and introduced grasses to grow during the winter, and plough them under in early spring. This practice is now almost general in the north, but it requires manures to first produce the conditions necessary to successfully raise the growth of green matter. At various periods manure should be given to stimulate the soil, and keep the tree supplied with the necessary food.

Nitrogen is largely required for the growth of the tree; nitrogen, phosphates, and potash for the annual production of good crops of fruit as will be shown. Every 1,000 lbs. of fruit contains the following:—

—	Nitrogen.	Potash.	Phosphoric Acid.
Oranges ..	2 bs.	2¼'bs.	1lb.
Lemons ..	1¼lbs.	2¼lbs.	1lb.

Nitrogen, if over supplied, causes soft green growth of the foliage liable to disease, and makes the rind of the fruit puffy and increases the rag.

Potash is plentiful in the soils considered, but the supply requires to be maintained.

Phosphoric Acid is deficient.

Nitrogen may be applied in the form of green manure, or gradually soluble blood and bone manures. Phosphates in the form of bone-dust; or, if readily required in the soluble form of superphosphates, and where trees show any lightness of colour, in the form of Thomas' Phosphate.

Potash is best applied as sulphate of potash. All manures should be applied in the autumn or early spring, early spring for preference, and every grower should have the benefit of a soil analysis. Manures are necessary, but require rational and intelligent application. The small feeding roots of the orange and lemon, immediately under the trees, absorb carbonic acid from the air; the soil above these roots should be lightly cultivated, and if mulching is carried out under the trees, only a dressing of two or three inches in depth should be given. Avoid fresh stable manures for mulching under the trees. Stable and farm-yard manures are beneficial, but should be well rotted, and applied equally all over the orchard. Equal manuring, equal cultivation, and equal watering induce the proper functions of the roots.

(*To be continued.*)

PANAMA CANALS.

Speaking at a dinner held by the London Chamber of Commerce, Senor Perez Triand, Chargé d'Affaires for the Republic of Salvador, told those present that " since the days of Columbus there had been numerous projects for building a canal, but there was one route in existence of which one heard nothing—it was there for the day when the requirements of trade and commerce would be so large that two canals would be needed. The route he referred to was the Atrato River, which flowed into the Gulf of Uraga, quite close to the Isthmus of Panama. It was a perfectly navigable river, and its upper reaches were comparatively near to the Pacific littoral. The site had been studied by a well known engineer, who stated that this route would be considerably cheaper than the Panama Canal. Humanity would so progress both materially and morally that the day would come when both canals would be free and open to the whole world."—*Tropical Life.*) Such a proposition must affect the primary producers of Australia to their great advantage. So haste the day when such a canal under such conditions is an accomplished fact.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

By the time these notes are issued, the orchard ploughing and cultivation should be completed. The winter has been exceptionally dry, and spring has set in early. It will, therefore, be very necessary to keep the surface well earth-mulched, so as to conserve as much soil moisture as possible. The experience of other years has shown that in spring time the ground hardens very quickly, especially in warm or windy weather, and so early ploughing is always a necessity. Even if rain follows the spring ploughing, it will be easy to cultivate afterwards.

That the season is an early one is indicated by the early blossoming of all kinds of fruit trees. The earliest pear tree in full bloom in the Burnley Orchards was a variety known as "Chinese," and this was in full bloom in the third week in July, while last season it did not reach this stage until the middle of August, and in 1911 it was in the same stage early in September.

These indications point to an early season; and it will be well to have both ploughing and cultivation completed early, in case the predictions of a mild season should not be realized. Ploughing and harrowing should be thorough, and all weeds and herbage should be well covered, and the surface tilth made as loose and clean as possible.

All cover crops intended for green manure should be ploughed in now. These may need breaking down with a disc, a roller, or with a chain on the plough before covering.

Spraying.

Spraying for all pests and diseases is now a prominent work in the orchard. Bordeaux spraying for black spot of apples and pears, for scab and shothole in apricots and peaches, for leaf curl of peach, and for rust of plums and peaches should now be completed. Where there are indications that previous sprayings have not been thoroughly successful, a second spraying should be given.

Wherever they are present, nicotine sprays should be used to combat peach aphis, and the pear and cherry slug. For the latter pest, arsenate of lead should not be used if the cherries are within a month of ripening. Arsenate of lead is so tenacious, and thus it is likely to remain on the fruit until it is ripe, when it would be dangerous to the consumer. Thus, while this property of remaining on the fruit for a considerable time is of great value in the codlin moth spraying, it is of quite the opposite value when used for cherry slug. Either tobacco water or hellebore is useful for the eradication of this

pest, as these substances do not remain long on the trees, and they are quite as effective as arsenate of lead.

Codlin moth spraying, too, will be in evidence this month. Owing to the early season, it is just possible that the development of the moth will take place earlier. It is generally assumed that the appearance of the moth is coincident with the bursting of the flowers. This is not always so—the moths frequently come slightly later than the bloom period. Owing to the rapid expansion of the fruit, it is well to follow the first spraying with a second in a week or ten days' time. Arsenate of lead is still the spray for codlin moth, nothing having been found to supersede it.

General.

Citrus trees of all sorts may now be planted, care being taken that neither the young trees nor the soil is allowed to dry.

Graft ties will need examining, and, where any growth has taken place, they may be loosened slightly. In hot, dry, or windy weather the grafts will benefit greatly by an occasional spraying with water. On such days the transpiration of moisture from the foliage is very great, and, so far, a perfect union has not taken place; thus there will be a loss of sap, which cannot readily be replaced, and the graft will probably suffer considerably.

Vegetable Garden.

The surface soil requires to be well pulverized at this time of the year; it should be kept well hoed, especially after the necessary frequent waterings, and all weeds must be suppressed. Apart from their harmfulness in robbing plants of food and moisture, the weeds, if allowed to remain and seed, become a menace to future economical work.

The top dressing and weeding of asparagus beds will now be necessary; the beds should be well cut over as often as necessary, removing all growths, small and large. It is a mistake to allow the small stems to grow on, because they may be too small for cutting.

Plantings of tomatoes may now be carried out; all early-planted plants should be fed, staked, and the laterals pinched back. A little bonedust or superphosphate may be given, but these are not equal to animal manures, if the latter are available. Chemical manures should be only given in a limited quantity. Six or 7 cwt. per acre would be a heavy dressing, and this works out at nearly 3 ounces per square yard. Vegetable growers may easily try this for themselves, and it will be seen that 3 ounces scattered over a square yard of surface will appear to be a very light dressing.

French beans, carrot, parsnip, celery, radish, peas, and turnip seeds may now be sown. Seeds of cucumber, melon, and pumpkin family may now be sown in the open ground. All seedlings may be transplanted on favorable days, and it will be well to sprinkle the tops when planting out, as well as to water the roots.

Flower Garden.

As in other sections, there should be no clods on the surface, the soil should be friable, and no surface cracking should be allowed. As often as a watering is given, so a hoeing should succeed this work. Flowering plants suffer exceedingly through loss of soil moisture, and hard and compact surfaces are detrimental to their successful growth. It is always helpful to plants, and especially so on hot, sunny, and windy days, to have the surface well hoed. In addition to conserving the soil water, it creates cool soil conditions, which are so helpful to good root action at this season of the year. Hoeing also keeps down the weeds, which need keeping down, and which should not be allowed to seed in the beds.

Roses will need attention, as both rose aphis and mildew will be making their appearance. For the former, strong tobacco and soap sprays, Robinson's Pine Spray, Benzole emulsion, and Soaperine are all very helpful in its eradication. For mildew, the plants should be dusted with sulphur when the foliage is moist; a dusting of sulphur on the ground under the bushes will be useful, as the fumes will be helpful in checking the fungus. All leaf-eating insects on any plants may now be suppressed with arsenate of lead, or with Paris Green.

Beds should be well dug over in preparation for chrysanthemum or dahlia planting; if these plants are not to be grown in separate beds, a few may be planted out for early flowering.

Bulbs that have finished flowering, and that have lost their foliage, should be lifted and stored. The foliage must not be cut off while it is still green, as this means loss of sap and energy.

Tender and half-hardy and other annuals may be planted out for summer and autumn flowers. These include asters, zinnia, salvias, balsams, amaranthus, celosias, &c.; lobelia, bedding begonias, iresines, and alternantheras may also be planted in the beds and borders.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition. April 15 to Aug. 14.	Aug. 15 to Sep. 14.	Total to date—5 months.	Position in Competition.
23	White Leghorns .	J. H. Gill	533	152	685	1
61	" ..	Jno. Campbell ..	481	133	614	2
48	" ..	Thirkell and Smith ..	472	141	613	} 3
65	" ..	E. A. Lawson .	480	133	613	}
11	" .	C. J. Beatty ..	465	144	609	5
6	" ..	J. S. Spotswood .	469	138	607	6
8	" .	E. H. Bridge ..	461	136	597	7
68	" ..	Jones and Curtis .	438	148	586	8
16	Black Orpingtons ..	D. Fisher .. .	436	144	580	9
10	White Leghorns ..	T. A. Pettigrove	434	144	578	10
31	" ..	W. G. Swift ..	436	136	572	11
46	Black Orpingtons ..	T. W. Coto	435	117	552	12
34	White Leghorns ..	J. E. Bradley ..	415	136	551	}
35	" ..	Moritz Bros. :	417	134	551	} 13
50	" ..	A. H. Mould ..	414	137	551	}
21	" ..	A. Ross	420	128	548	16
49	" .	M. H. Noye ..	399	137	536	17
7	" ..	H. McKenzie	389	143	532	} 18
37	" ..	C. H. Busst .	391	141	532	}
66	" ..	W. Featherstone	393	127	520	20
32	" ..	H. Hanbury ..	370	140	510	21
40	" .	Geo. Edwards .	372	134	506	22
20	" ..	C. B. Bertelsmeier ..	365	138	503	23
26	" ..	B. Rolls . .	374	125	499	24
43	" ..	Morgan and Watson ..	367	128	495	25
5	" ..	G. W. Robbins ..	345	148	493	26
47	" .	W McLister .	375	112	487	27
63	" ..	A. Sellers	355	131	486	28
2	" ..	R. W. Pope ..	356	129	485	} 29
41	" .	Percy Walker ..	356	129	485	}
13	Black Orpingtons .	T. S. Dallimore .	351	128	479	31
58	White Leghorns ..	Stranks Bros. .	349	129	478	32
39	" .	W. Purvis .. .	354	123	477	33
24	" ..	Redfern Poultry Farm	344	126	170	34
38	" ..	M. A. Monk .	342	127	469	35
67	" ..	C. Hepburn	344	115	459	36
45	" ..	D Gouddie	333	124	457	37
25	Black Orpingtons ..	King and Watson .	337	118	455	38
59	White Leghorns ..	Cowan Bros .	318	132	450	39
14	" .	F. Hannaford .	338	111	449	40
3	" .	S. Buscumb .	311	122	433	} 41
18	"	B. Rowlinson .	311	122	433	}
52	" .	W G. Osborne .	300	128	428	43
55	" .	P H. Killeen .	305	121	426	44
27	" .	J. Sinclair .	312	103	415	} 45
42	" ..	A. Stringer .	275	140	415	}
33	" .	South Yan Yean Poultry Farm	273	141	414	47
22	" .	B. Mitchell	285	122	407	48
62	" ..	G. A. Gent ..	285	121	406	49
12	" ..	A. H. Padman ..	248	145	393	} 50
53	Black Orpingtons .	A. Greenhalgh ..	258	135	393	}
56	White Leghorns ..	Schaefer Bros. .	254	132	386	52
44	" ..	W. A. Rennie ..	260	124	384	53
54	" ..	Jas. McAllan .	232	145	377	54
57	" ..	Gleadell Bros. ..	256	113	369	55
51	Black Spanish ..	W. H. Steer ..	243	125	368	56
36	White Leghorns ..	A. J Jones	237	125	362	57
17	R.C. Brown Leghorns	S. P. Giles	260	97	357	58
19	White Leghorns .	W. Dunlop ..	243	108	351	59
28	" ..	E. Waldon .	236	114	350	60
29	" ..	S. Brundrett ..	189	141	330	61
64	Golden Wyandottes	C. L. Sharman ..	191	126	317	62
30	Black Orpingtons ..	Jas. Ogden ..	177	138	315	63
15	White Leghorns ..	J Shaw .. .	189	95	284	64
60	Black Spanish .	Watson and Rushworth	155	128	283	65
4	White Leghorns ..	Jas Brigden ..	151	110	261	66
9	" ..	Sylvania Stud Farm ..	132	95	227	67
		Totals	22,391	8,612	31,003	

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

Monthly Report, ending 14th September.

The fifth monthly report of the above competition is as follows:—

The weather during this month has been mild, with the exception of the first four days, when rain fell, and it was foggy and damp. The lowest morning temperature was 33 deg. Fahr., the remainder of the month being mild. This has accounted for the increase in egg production, the output being 8,612, as compared with 7,620 eggs last month.

The leading pen, J. H. Gill (pen 23), has now a grand total of 685 eggs; the second, Jno. Campbell (pen 61), has 614 eggs to its credit; while A. E. Lawson (pen 65), and Thirkell and Smith (pen 48), 613 eggs, are equal for third place.

Food.—The morning mash was similar to that of the former month, and at mid-day a mash of bran and pollard, mixed with hot liver soup, was given. On several occasions raw onions were cut up fine and mashed into the pollard. Grain consisted of wheat, except during cold winds and wet weather, when a mixture of wheat, five parts, and maize, three parts, was fed. Green food at mid-day consisted of grass, thistles, and green lucerne chaff, which were also fed in the morning mash.

Broodiness is becoming more pronounced as the warm weather advances. Several of the pens of heavy breeds have had three broodies, while three pens of Leghorns are showing symptoms. one in particular (pen 23) being cooped; the others are pens 54 and 48.

The general health of the birds is excellent, all being bright and vigorous.

The total rainfall for the month was 111 points.

REMINDERS FOR NOVEMBER.

LIVE STOCK.

Horses.—Continue to feed stable horses well; add a ration of greenstuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses. Feed old and badly conditioned horses liberally. If too fat, mares in foal should be put on poorer pasture.

Cattle.—Except on rare occasions, rugs may now be used on cows on cold and wet nights only. Continue giving hay or straw. Beware of milk fever. Read up method of treatment in *Year-Book of Agriculture*, 1905. Have cows' milk weighed and tested for butter fat. Rear heifer calves from cows giving satisfactory results. Give calves a warm dry shed and a good grass run. Keep calves' premises scrupulously clean and regularly disinfected with Phenyle or Condy's Fluid. Feeding vessels must be kept clean. Skim milk should be scalded, unless it is known that the cows are healthy. Give the calves a regular quantity, and do not overfeed. Better too little than too much. Give milk at blood heat. Dehorn all calves, except those required for stud or show purposes.

Pigs.—Supply plenty of bedding in warm well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Read articles on breeding and feeding in *Journals*, April, 1912, and June, 1913.

Sheep.—Prepare for dipping. Powder or paste dips have the most lasting effects, particularly where lice have been bad. Ascertain correct contents of bath before mixing the dip. Keep sheep in bath not less than half a minute, if badly infested, longer. Submerge heads twice. Dip big sheep first, lambs last. Yard sheep overnight; dip while empty, and avoid fouling the drainer so much. Commence early in the day, and the sheep can dry before nightfall. Avoid travelling long distances to baths and dipping sheep while overheated. Do not roughly throw sheep in. Avoid filthy baths, particularly in hot areas; filth increases a dead tip; clean out the bath occasionally. Merino and fine comeback ewes come in season, as a rule, now. Mate plain roomy ewes to level, thick-shouldered, good-fleeced Lincolns; yolky, wrinkley sorts to English or Border Leicesters; very small merino ewes to blue-faced, medium-boned old type of English Leicester, as they cause less lambing troubles.

Poultry.—Provide plenty of green food and shade. Watch for vermin; spray perches with kerosene and houses with solution of 3 per cent. crude carbolic acid mixed with a little lime and soft soap. Keep water clean and cool. Discontinue feeding maize and reduce meat ration. Some Epsom salts should be placed in water weekly. Fresh skim milk, if available, should be given. Remove all male birds from the flock. Infertile eggs only should be used when pickling, or when placed in cool storage.

CULTIVATION.

Farm.—Plant main crop of potatoes. Cut hay and silage. Weed early potatoes. Sow maize and millets. Weed tobacco beds, and water, if dry.

Orchard.—Ploughing, harrowing, and cultivating to be continued. Weeds to be kept down. Secure, pinch, and spray grafts with water. Spray frequently for codlin moth, pear and cherry slug, and peach aphis. Plant out citrus trees.

Vegetable Garden.—Hoe and mulch surface. Suppress weeds. Water where dry and hoe afterwards. Disbud and pinch back tomato plants. Sow celery, French beans, peas, lettuce, cucumber, melon, &c., seeds.

Flower Garden.—Water and mulch. Cultivate and keep down weeds. Thin out weak wood from roses. Prune early all flowering shrubs that have finished flowering. Lift and store bulbs. Plant out dahlias and chrysanthemums. Liquid-manure herbaceous perennials.

Vineyard.—Field grafts require careful attention in the way of removal of suckers and scion roots. Cultural work, such as scarifying and hoeing, should be actively pushed forward, so as to provide as good a " mulch " as possible during summer. Proceed with tying up, stopping, and topping. Avoid excessive topping, summer pruning being usually more injurious than useful in warm, dry climates. Cincture Zante currant vines as soon as flower caps have fallen. Apply second sulphuring just before blossoming, wherever Oidium was prevalent last year.

Cellar.—Same as last month.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 11. 10th November, 1913.

CITRUS CULTURE IN VICTORIA.

(*Continued from Page 642.*)

PART VII.—PACKING, CURING, AND MARKETING.

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

The success of marketing depends on the care and attention bestowed on the picking, handling, and packing. Oranges are picked as they ripen, and none but ripened fruit should be picked. Clean, bright-coloured, firm fruit, of even character, put up in an attractive manner, command the best prices. Oranges should be cut off the tree, not pulled, as pulling may tear or damage the rind. The fruit should be carefully gathered and handled to prevent bruising, and placed in boxes, and the boxes placed in a thoroughly ventilated shed, and allowed to remain for three or four days. Under this treatment oranges go through a process of sweating, which allows the surplus moisture to escape, and renders the rind tough and pliable; it also shows up all bruises, spots, and imperfections of the fruit. If packed straight from the tree, sweating and heating will result, and set up decay. After sweating in the boxes the fruit should be carefuly graded, and put up according to its size, colour, and condition; and the cases should be branded according to the degree of perfection and size, "Special," "Fine," "Bright." "Special" oranges should be of extra large and uniform size, very thin-skinned, smooth, and of the finest colour. "Fine" should be large and uniform in size, bright in colour, smooth, with thin skin. "Bright" should be of uniform size, good colour, and free from blemish or discoloration of smut. The remainder of the crop should be graded according to size, and marketed without any special brand. Culls, green, immature, and imperfect fruit should never be marketed. Cases should be branded with the varieties they contain, also the number of fruits. Marketing, as practised now by the individual grower, is not the best method. Combination and packing under a special brand and grade is preferable. If packing individually, growers should have proper stencil

plates, with their name, orchard, district, variety, and grade; also number, thus—

GROWN AND PACKED
BY
W. THOMPSON,
PALERMO ORCHARD,
KOONDROOK.

W. NAVEL.
SPECIAL. 60.

on end of the case only. In packing great care and attention is necessary, and if grading machines are not used, one orange should be used as the standard for each case. The cases at present used are the single case, 26 inches long by 6 inches broad by 14¼ inches deep, inside measurements, clear of division, 2,223 cubic inches, or one Imperial bushel; also the export case, 18 inches long by 8⅞ inches broad by 14 inches deep, no division, 2,237 cubic inches. The latter case should be more generally used, and should not be made of unseasoned wood; too much loss is already sustained, in apple export, by moisture from the green wood extending to the fruit and wrapping-paper during transit over long distances, and setting up decay. Cases made from well-seasoned pine wood are the best. In packing for export or special grades, the fruit should be wrapped separately, and packed on the numerical system of packing, known as the diagonal pack. This is preferable to the layer system, where fruit is packed in rows one immediately over the other, as it brings each fruit over the space between the two, gives more elasticity to the pack, and prevents injury in transit to a large extent, as the fruits are dovetailed one against the other and immovable; it also allows of more fruit to the pack. The fruit should be firmly packed, and the size regulated, so that the last layer stands about ½ inch or ¾ inch above the top of the case; the lid should then be placed on the case, and held in position, and the fruit carefully pressed at one end of the box, and the lid nailed, and the other end afterwards treated similarly; this allows the centre to bulge, and does not press the fruit, which carries without bruising. The sizes at present packed are from 48 to 140 for Washington Navels. In the long bushel case very large Navels run only to 48; they are generally badly packed. The better case for large Navels is the export case; it allows of more compact and equal packing. The size preferred for local market is from 75 to 120 to the case. For export, 75 to 100 to the case is preferred. For ordinary oranges, packing in the long bushel case, what is known as the double six, with a five centre, and double five, with a four centre, is preferred. This means six long and six deep on the sides, and five long and five deep in the centre, or 16 dozen to the case; or five long and five deep on the sides, and four long and four deep in the centre, or 11 dozen to the case.

Lemons should not be allowed to ripen on the tree. The fruit should be picked when it has reached the size desired, viz., 2¼ inches diameter; this is the size preferred by the trade. The fruit should be cut from the tree, and the stem cut close to the fruit, with a secateur. The fruit should be handled as carefully as eggs. Pickers should wear gloves, as

long finger nails scratch the skin of the lemon. Lemons should be picked green, or at the first appearance of a change of colour from green to yellow. Lemons ripening on the tree may exceed a marketable size; they also lose quality, and become coarse. Lemons, when picked, should be carefully washed in clean water, and thoroughly dried with a soft rag; or they may be sponged—this is done to remove all dust and dirt. They are then cured according to the requirements of the market. If required immediately, they are placed in a dark room to sweat, and the temperature raised to about 90 deg. Fahr., and pails of water placed about the room to keep the air moist and prevent shrivelling of the fruit, and in four or five days the lemons should be of a good yellow colour. They can also be placed in a dark room—a cellar for preference—and a damp, close bag thrown over the top of each case; this brings about a similar result to the former method, but is not so satisfactory, as the lemons ripen unequally. If not required for immediate use, the lemons should be picked and stored in boxes, placed away for two or three

Plate 39.—Mediterranean Sweet Orange trees, 12 years old, showing average type of tree and fruit packing, 11 dozen to the long bushel case.

weeks in a well-ventilated shed, having a temperature of not more than 70 deg. Fahr. or less than 60 deg. Fahr., in order to dry the moisture out of them. The fruit should then be carefully wrapped in tissue-paper, and placed on trays 3 feet by 2 feet by 3 inches deep, with a cleat on each end; this allows for plenty of air circulation. The trays are stacked one on the other. The temperature should then be kept at not more than 60 deg. Fahr. or less than 50 deg. Fahr. The shed should be well ventilated and dry, and the fruit should not be allowed to heat or sweat. The lemons should be overlooked at intervals, and any decaying fruits removed, as they cause the adjacent sound fruits to decay. Another method is to pick the fruit from the tree, and store it into racks which are fitted under open-sided sheds, and the temperature regulated by side covers, which can be adjusted to weather conditions, both night and day.

Early picked lemons cure the best. Excesses of temperature must be avoided. Stacking fruit in piles should not be practised. Properly

regulated ventilation is essential, and lemons will keep for months. Our main crop of lemons treated under these conditions must become a payable one, as they will come into use in the heat of summer, and command high prices.

Lemons should be picked before irrigation, or, if rain falls, wait for several days. Pick over the trees at fortnightly intervals when the fruit is dry, and when the fruit is picked do not leave it exposed in the sun. Lemons should be carefully placed in the picking baskets, not dropped in. Picking baskets should be padded. After curing, and in packing for market, unwrap the fruit, and re-wrap and grade according to size. Brand the cases according to the grade "First" or "Second." "First" grade lemons should be of uniform size, with waxy golden skin, and without a blemish. "Second" grade should be of good colour and sound. Great care should be used in packing, and every lemon in the "First" grade should be wrapped. The number of lemons to the case should be stencilled on the case.

The prospect of the industry is remarkably good.

Production for Season 1911-12.

State	Lemons	Oranges.
	bushels	bushels
Victoria	65,833	48,982
New South Wales	256,433	946,196
Queensland	3,529	474,025
South Australia	47,176	220,988
Western Australia	16,317	76,552

Area or Number of Trees, 1910-11.

Victoria.	Lemons.	Oranges.
Bearing	47.880	44,190
Non-bearing	20,070	44,403
Approximate estimate of trees planted, 1912	10,000	40,000

Commonwealth Trade.

——	Production, 1910–11.	Imports, 1911.	Exports.	Net Imports, 1911.	Approximate Consumption.
	bushels	bushels	bushels	bushels	bushels
Oranges and lemons ..	1,927,125	39,430	1,205	38,225	1,965,350

Victorian Trade.

Approximate consumption	500,000 bushels
Yield, oranges and lemons, 1911–12	114,815 ,,
Deficiency ...	385,185 bushels

The big margin for local consumption will take a long time to make up. The low average yields of orange and lemon trees can be explained by the fact that the great majority of them are young and just coming into production. This fact, and the large planting that is being carried on, must eventually force the producer into the export market. That market is open to him in the Northern hemisphere, both in Great Britain, Europe, and America. Oranges should be, and can be, landed in London and New York in July, and a regular supply kept up from then until October. At the time Victorian oranges would land in the places mentioned, those markets are depleted of European and Californian oranges. South Africa and West Australia are nearer ports to the markets of the Northern hemisphere; they are also citrus-producing countries, and are competing for the markets, but prices are remunerative, and the population of Great Britain, Europe, and America increasing.

Spain, Italy, Turkey, Egypt, and the Canary Isles are the chief producers of citrus fruits for the European markets. The imports of oranges into the United Kingdom in 1911 was 259,000 tons. Cape Colony sent 15,000 cases from June to September, and obtained an average price of 12s. per case for a case of 12 inches by 12 inches by 26 inches with centre divisions. Prices have, however, ranged as high as 20s. a case. Victoria has never attempted to export oranges. Apple exporters in this State are satisfied with 10s. a case for export apples. Orange trees are more prolific than apples, and are more constant in their bearing habits. Assuming the total cost, packing, cases, freight, and charges, to amount to 6s. per case, there remains from 10s. a profit of 4s. per case, and even at that price the orange orchard must be a profitable concern. These prices are low as compared with prices at present obtained, and, while prices are high locally, exporting will hardly be favoured by the producer. The expansion of the industry will, however, force it on the grower, and it is time to begin and obtain entry into these oversea markets, and gradually build up a trade which is capable of large expansion. There are thousands of acres of citrus-producing country in Victoria. Oranges can be produced as cheap here as anywhere in the world. Land is low-priced, injurious frosts almost unknown, and water cheap. Trees are prolific, and the fruit unexcelled as regards quality and colour. Small quantities produced, and realizing high prices, do not tend to general consumption. Large quantities produced regularly, and commanding payable prices, place the fruit within reach of all classes, and thereby increase consumption. We have not yet exported lemons to the oversea markets, but there is a large trade to be opened up in America, Great Britain, and Europe.

America imports annually about 60,000 tons of lemons. The European demand is an increasing one, and the room for expansion in production in the Mediterranean countries limited. Victorian lemons should be able to enter these markets in June without much danger of loss in transit, and with every prospect of remunerative prices.

In exporting combination is a necessity. Fruit should be sent under a district brand, and the grading, packing, and general get-up of the package of the very best. Shipments should be sent through proper channels for distribution, and supplies should be regular and increasing.

Washington Navels and the Navel types will be the most profitable oranges to export, and lemons of the Lisbon variety. In citrus, as well as other branches of fruit culture, it is not wise to grow too many varieties; a better market is assured by producing a quantity of a given kind.

(To be continued.)

BEE-KEEPING IN VICTORIA.

(Continued from page 588.)

By F. R. Beuhne, Bee Expert.

XVIII.—BEESWAX.

"Beeswax has its origin in the nectar or honey consumed by bees and transformed by them into fatty matter by a process of digestion and secretion. It is an organic, not a mechanical production, and issues in the form of scales from between the ventral plates of the abdomen of the worker bee." (T. W. Cowan, Wax Craft, page 45.)

The production of wax by the honey bee is in a certain ratio to that of honey; thus, bees in trees or box hives yield, on the average, one pound of wax to twenty pounds of honey. With the introduction of the bar frame hive, and the method of extracting the honey from the combs and returning them to the hive to be refilled with honey by the bees, the ratio of wax to honey has been considerably altered and stands at 1 to 80. In other words, the production of extracted honey for the same weight of wax is four times that of the primitive method of cutting out the combs to obtain the honey. As a result, the price of honey has declined while that of wax has advanced during recent years. The wax is the product of a transformation of the honey or nectar when retained in the body of the bee for a time under certain conditions. Many attempts have been made to turn surplus honey into wax by feeding it back to the bees, but none have proved successful from a commercial point of view. While, therefore, the proportion of wax to honey cannot be profitably increased, so far as its production is concerned, there is room for much improvement in the methods of obtaining the wax from the combs, in the handling, refining and marketing.

Thousands of pounds of beeswax are annually thrown away, or burned with old black brood combs, because the old-fashioned method of boiling the combs in a bag submerged under water fails in obtaining more than a mere fraction of the wax contained in them. New comb consists entirely of wax, and is white or yellow in colour, according to the flora from which the bees obtained the nectar converted into wax. When brood is reared in the cells the comb first becomes brown and, after a time, black, tough, and heavy. Each bee larva, before changing to the chrysalis stage, spins a cocoon, and as generation succeeds generation in the same cells old brood comb contains numbers of these in each cell, one inside the other; but, although the appearance of the comb is entirely changed, the original wax cells are still there. When old brood

comb is dissolved by boiling in water each of the cocoons set loose by the melting of the comb becomes coated with liquid wax which clings to the fibrous material of the cocoons, and but little will rise to the surface when boiled in a bag kept under water.

To obtain all the wax, or at least the maximum from old combs, pressure is required—something of the nature of a cheese press. The press shown in the illustration (Fig. 1) is a stout wooden box securely bolted together and lined with tin; inside of this is a slatted grating and bottom, leaving a chamber of 10 x 10 inches (12 inches deep) into which an ordinary sugar bag is inserted. The old comb is dissolved by boiling and poured into the bag, the latter is then folded down, the press block put on, and the screw gradually worked down. Water and wax escape by the outlet into a separating tank which retains the wax, but allows the surplus water to escape.

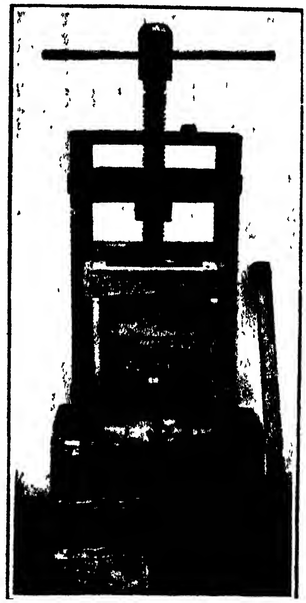


Fig. 1.—Wooden Wax-press.

Fig. 1 shows the press complete, excepting that a board should be fastened across the top of the uprights with a hole to guide the screw, so that it works evenly and steadily. The uprights should either be securely fastened to the floor of a little platform or braced to the wall by stays at the top. The frame consists of two uprights, about two feet eight inches long, made of 6-inch x 2-inch timber, with cross piece of similar dimensions at the top, and a floor piece 12 inches wide near the bottom, the four being mortised and bolted together at the intersections, the screw block being slightly let into the cross piece and bolted. The screw is a 2-inch wooden carpenter's bench screw. The body of the press is made of $\frac{7}{8}$-inch shelving, blocked or dove-tailed together at the corners, and measures 11$\frac{3}{8}$ in. x 11$\frac{3}{8}$ in. inside by 12 in. deep. The bottom is fitted into the body flat on the underside; the upperside has an incline of 1 inch from the sides to the groove in the centre, which latter inclines towards the outlet in front, as shown in Fig. 2. A frame 3 inches wide runs round the top of the body, bracing it together, and projecting upwards by 1 inch over the top edge of the body, forms a rabbet $\frac{7}{8}$ inch x 1 inch. The whole body is lined with tin inside, the groove terminating in a spout. Figures 3, 4 and 5 show the fittings inside the lining. Fig. 4 is the bottom of the grating, made of pieces of wood $\frac{7}{8}$ inch thick and 1 inch deeper in the centre than at the ends, to correspond to incline of the bottom of the body, on the lining of which they rest. They are $\frac{1}{2}$ inch apart, and slats $\frac{3}{8}$ inch wide by $\frac{5}{8}$ thick, set 3-16th apart, are nailed crossways on to the top of them as shown in Fig. 4.

Fig. 3 shows the four sides of the grating, each of which is unconnected with the others, and consists of slats $\frac{7}{8}$ inch x $\frac{5}{8}$ inch, set 3-16th apart, nailed on to a piece 1 inch x $\frac{7}{8}$ at top, which rests on the rabbet

at top of body, when inserted in the latter. A doubled piece of tin in a sawkerf made endways into the slats connects them at the bottom without obstructing the passage of the liquid pressed.

Fig. 5 is the press block, made of a piece of hardwood, with stout iron handle, which is raised and a lever put through when the block is to be lifted. A board $\frac{3}{8}$ inch thick and measuring 10 inches x 10 inches (which is the clear measurement inside the grating), fastened to the hardwood block, has slats the same as the sides of the grating.

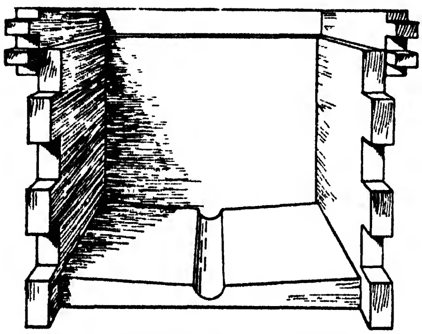


Fig. 2.—Cross Section of Press Box.

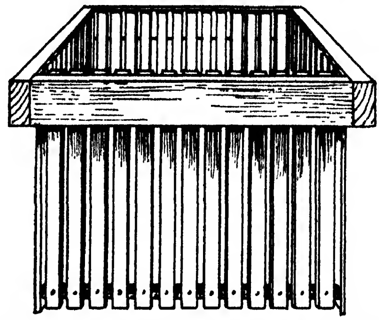


Fig 3.—Inner Slatted Sides of Press Box.

For pressing honey out of cappings or comb, a piece of hessian sufficiently large to lap over double when the press is full, is tucked into the grating. If there is any difficulty in getting the pressed cake out of it it is overcome by drawing out one or two of the sides of the grating.

For pressing wax from combs, press cakes or refuse, it is best to use a bag, just fitting inside the grating. The bag should be of good hessian

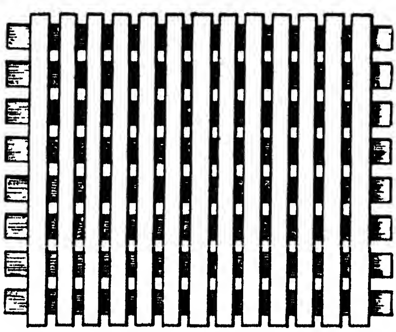


Fig. 4a.—Top view of Bottom of Press Block.

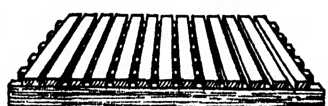


Fig. 4b.—End view of Press Box

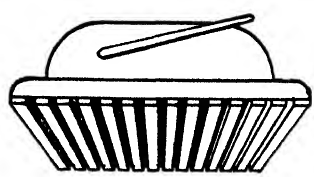


Fig. 5.—Press Block.

or similar material, with a square bottom like a woolpack. The wax should be boiled up with water, and before the first lot is poured into the press, the bag should be inserted and boiling water poured in to prevent the wax adhering to the bag and woodwork when it cools. When fully pressed down unscrew, lift out the press block, shake up and fold the bag afresh, and press again, or pour in more if there is but little

refuse. The liquid wax and water run into a receptacle standing under the spout, and are separated by means of a separating tank described further on.

There are several types of wax presses, and while a wood-slatted one, as the one described, is preferable, its construction requires a certain amount of skill and handiness with tools not possessed by every bee-keeper. A press made almost entirely of metal is obtainable from dealers in bee-keepers' supplies. Fig. 6 is the press ready to set up; also two moulds for wax cakes at the back. In Fig 7 the different parts are shown.

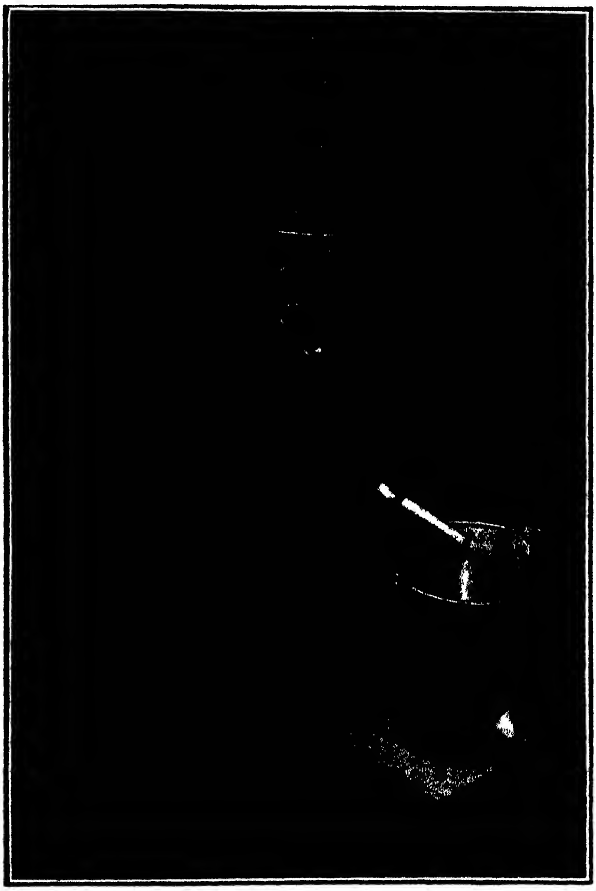


Fig. 6.—Metal Wax Press, set up.

The amount of wax obtained from old black combs by means of a press, as compared with the old method, is as three to one, while the time occupied is but one-tenth, and the wax obtained is ready for market if drawn off into suitable cooling vessels, such as the moulds shown in Fig. 6.

About 75 per cent. of the wax sold by produce salesmen is depreciated in value through having been wrongly treated at the apiary, Wax should never be overheated; it should always be melted or boiled with water. Wax boiled in rusty tins or iron vessels has a dirty brown appearance; contact with galvanized iron or zinc turns it grey, copper green. Bright, new tin or tinned copper vessels are the only ones which do not affect the colour and character of wax. Even the oldest comb will produce wax of a clear yellow or orange colour if properly treated. The size and shape of the blocks of wax seen on the market also leaves much to be desired. The moulds used by many bee-keepers are buckets, old milk-dishes, kerosene tins, wash-tubs, &c., into which the wax has been poured, and left to set quickly in contact with the metal instead

of on hot water. The result is that the dirt, which will pass even through the finest strainer, is diffused all through the lower part of the wax instead of being in a separate layer, which can be scraped off. Quick cooling results in unsightly cracks and clinging to the moulds. Wax is often sent to market in bags, and the fibre and dust adhering to it still further spoil its appearance. Blocks or cakes should not be larger than 20 lbs.; 10 or 12 lbs., however, is the best weight.

Better attention to the saving, proper handling, and marketing of bees-wax would well repay the bee-keeper, and add considerably to the total annual value of production.

Fig. 7.—Metal Wax-press showing parts.

When an apiary has been in existence for a number of years it becomes necessary to replace some of the old black brood combs. This should be done every season — whenever an opportunity offers to withdraw them from the brood-chamber. They should then be replaced with new ones.

A Langstroth comb, if built on a full sheet of foundation, contains about 2 ounces of wax when new, but somewhat more after it has been in use for some years, as the bees add wax after the foundation is first drawn out. When very old combs are boiled down for wax, not more than eight should be put into each tin with three gallons of water, otherwise the mass becomes too stiff and difficult to press clean of wax. Sometimes, hundreds of combs have to be cut out and boiled down and a great number of vessels would be required to hold the water and liquid wax coming from the press until the wax is set, unless it is skimmed off while hot, which is tedious work.

By the use of a separating tank, wax and water can be separated automatically, the wax being retained in the tank while the waste water,

if not too thick and black, can be used for boiling down more combs or else at once disposed of. Waste water from boiling down combs or water containing honey should not be thrown out so that bees have access to it, but should be buried; apart from any risk of spreading disease it may start robbing or stinging.

This separating device (Fig. 8) consists of a plain box lined with tin. One corner of the lining is covered by an L-shaped piece of tin soldered to the side and end, open on top and reaching only to within half an inch of the bottom, with an outlet stud through the end board

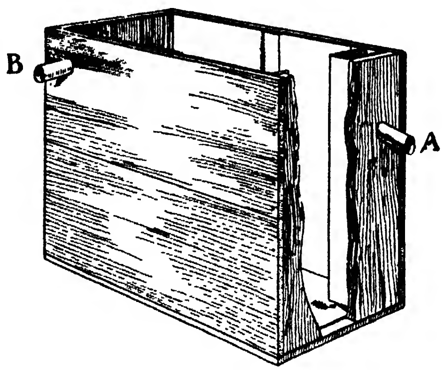


Fig. 8.

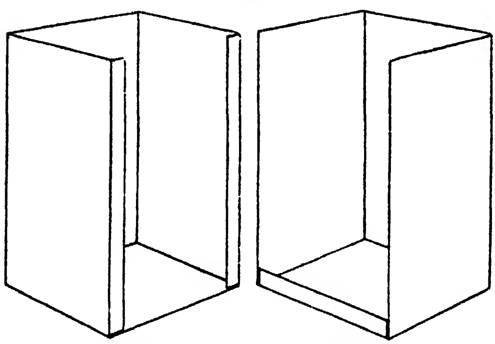


Fig. 9. Fig. 10.

Fig. 8.—Separating Tank. Figs. 9 and 10.—Lining of Tank.

of the case about four inches from the top. At the opposite corner of the case is another outlet stud two inches from the top.

Before allowing the wax to run into the tank from the press, sufficient hot water should be poured in to cover the end of the enclosed corner so as to prevent the wax escaping into it. After several lots of boiled comb have been put through the press, the wax and water will have risen in the tank to the level of the outlet tube A, and from now an amount of water, equal in weight to the water and wax coming from the press, will run over by tube A.

As wax is considerably lighter than water, it does not displace water by its own volume, and therefore rises in the main body of the tank as

it accumulates until it reaches the wax outlet tube B. This is best kept corked till it is desired to draw the wax into moulds or a cooling vessel, when by opening the wax tube B and closing the water outlet A the whole of the accumulated wax flows over when more liquids run into the tank from the press or sufficient hot water is poured into it.

A serviceable tank of this description can be made out of a kerosene case and two tins by any one able to use a soldering iron. Cut the tops out of the kerosene tins, close to the rim, and hammer back the cut edges. Then cut the side out of one tin, as shown in Fig. 9, and the other as in Fig. 10; put the tins into the case, straighten out the pieces left for lapping over in Fig. 9 and the bottom piece in Fig. 10; then solder together. Withdraw the lining from the case, cut the holes for outlets A and B into lining and case, reinsert the lining and solder on the studs (which should be at least one inch in diameter) and the angle piece covering A. The work is then completed.

This receptacle, if emptied and wiped dry after use, will last for many years, as wax has a protecting influence on tin. It will save a great deal of labour by dispensing with skimming and remelting; water will also be economized, an important consideration to bee-keepers who are located in dry districts.

(To be continued.)

QUALITY IN POTATOES.

Potatoes of any variety are subject to vary considerably in composition according to the conditions of growth. Climate, soil, and manure have each an effect upon quality. The criterion in judging potatoes is the percentage of starch and dry matter which they contain. Poor potatoes are watery. A dry season and a light soil give better quality tubers than the opposite conditions. The kind of manure used has also an influence, and *Bul. II.* of the *W. of Scot. Agric. Coll.* sums up the results of three years' investigations on this subject. The analyses were confirmed by cooking tests. Nitrogenous manures alone, without phosphates and potash, lowered the quality. Stable manure, being rich in nitrogen, also gave poorer quality than no manure, and this effect was more marked in a dry season, presumably because the stable manure also made the soil moister by comparison with the no-manure land. Phosphates, such as superphosphate, improved the quality either alone or in mixtures. The same was true of potash manures. Of the different potash manures, the sulphate gave better quality than the muriate in each of some twenty tests. The good quality potatoes keep best during storage. For practical purposes, quantity must be sought as well as quality, and, to obtain the maximum result in cropping, a half, rather than a full, dressing of stable manure is recommended, this half-dressing being supplemented by a small dressing of superphosphate and sulphate of potash, with a little sulphate of ammonia added where the land is not in too good heart.

CENTRAL RESEARCH FARM, WERRIBEE.

Farmers' Field Day.

[Extracts from the report in the *Werribee Shire Banner*, 9th Oct., 1913.]

The farmers of the State responded splendidly to the invitation of the Government to attend the First Annual Field Day at the Central Research Farm, Werribee, on the 26th September. Advantage was taken of the gathering together of agriculturists at the Royal Show to introduce to them the latest work being undertaken in their interests by the Department of Agriculture. From Mildura and Orbost, Casterton, and Tallangatta, the Goulburn Valley, and the Wimmera there was an adequate representation of farmers engaged in wheat growing, irrigation, dairying, and other phases of agriculture. The local farmers, led by the President (Mr. John Ball), and Secretary (Mr. Tyzack), of the Werribee Agricultural Society, turned up in large numbers, and helped the Department materially in supplying vehicles for the con-

Fig. 1.—The Hon. Geo. Graham, Minister of Agriculture, welcoming the visitors.

venience of visitors. There was also present an interested sprinkling of commercial men, government officials, and parliamentarians, on the goodwill of the latter of whom depends the supply of the sinews of war for the carrying on of the enterprise. And, after the inspection, when the 650 visitors were gathered in the implement shed, enjoying a cup of afternoon tea, there was general agreement as to the satisfactory work already accomplished on the farm, and as to the likelihood of the experimental work in course of progress being of very great benefit to agriculture.

To judge from the remarks heard while mingling with the crowd during the afternoon, it was apparently realized that the Government had entered on a project destined to be of real value to the farming community, and to which the farmers of the State might look for real and practical guidance in the improvement of generally practised methods.

The Minister of Agriculture (The Hon. Geo. Graham, M.L.A.), in welcoming the visitors at the entrance gate to the farm, said he wished to impress upon those present that it was only a little over twelve

months since the Department of Agriculture had obtained possession of the farm. The land was about the worst in the district, and was practically worn out; some parts of it had been growing hay for close on thirty years without a rest. It was intended that this was to be the principal Research Farm of Victoria. This was the only site to meet all the requirements that could be obtained within a reasonable distance of Melbourne. It was not the best land, but it had the advantage that research, both dry and irrigation farming could be carried on, and it was easily accessible to farmers from all parts of the State. The pro-progress made would be seen as the years rolled by. It was intended to make this event an annual affair so that those interested in agriculture would be able to visit the farm and see the development and progress of it.

Fig. 2.—Dr. Cameron intimating the Route of Inspection.

He felt certain that when they had looked over the farm, and had seen the experimental work that had been laid out, they would recognise that the Government was doing the right thing.

The officer they had taking charge of the work (Mr. Richardson) had the three qualifications required to make it a success, viz., agricultural scientific knowledge, practical agricultural knowledge, and, on the top of that, enthusiasm in his work. Mr. Richardson was ably supported by Mr. Wilson, the Farm Manager, who was also an enthusiast who had his heart and soul in the work. All the work performed on the farm had been done under the direct supervision of Dr. Cameron, the Director of Agriculture.

It had been intended that Mr. Richardson, Agricultural Superintendent, should explain the plots as they went along. Unfortunately he had been taken ill early in the week, and, though present, was not at all well. Dr. Cameron would step into the breach and explain the work being carried out.

Dr. Cameron explained the route the inspection would take, and gave an outline of the work done at the farm up to the present time. He addressed the gathering at various points during the inspection. Mr. H. C. Wilson, Farm Manager, also gave short addresses as the tour proceeded, and the Field Stewards, amongst whom thirty of the local farmers were prominent, explained the crops and plots to groups and knots of farmers who separated from the main body.

Most interest was concentrated on the permanent rotation field, the grading for irrigation, the green manurial tests, the permanent fertilizer field, the barley varieties, the top-dressing of natural pasture, the grass-seeding experiment, the lucerne plots—both experimental and commercial, the wheat breeding and cereal seed selection areas, and the bulk wheats for seed distribution.

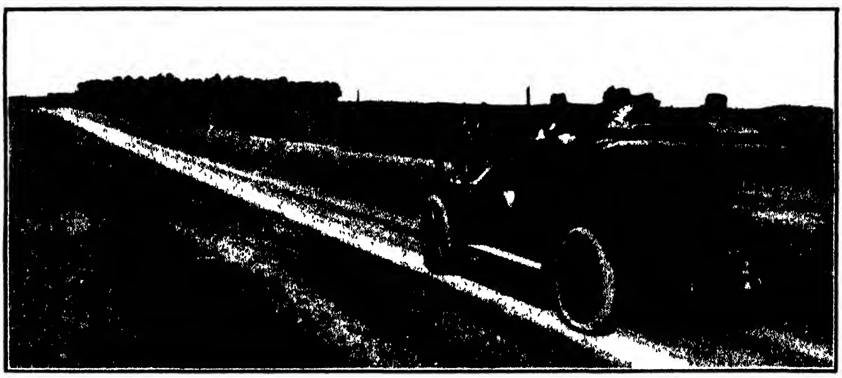


Fig. 3.—Visitors spreading out.

On the conclusion of the inspection, the Honorable the Speaker (Sir Frank Madden, M.L.A.), in proposing a vote of thanks to the Minister for arranging the trip, endorsed what had been said about the worn out land. Some portions of this farm really needed forty years' rest to enable it to recover its fertility. However, the Government was going to treat it by true farming methods, whereby even now it could be seen that it was commencing to give a return. The peas and legumes was a crop that would be a credit to any place. If it was his crop he would roll it down and plough it in. The great need of worn out land was the provision of humus which could be restored by the ploughing-in process.

He had always desired to do what he could for the benefit of Victorian agriculture. The starting of this farm was a step in the right direction. He trusted the Government would not be frightened by the cost of this experiment work, because, although it might be costly in the beginning, it would teach the farmers of the State what could be done by modern science, and would return its cost to the State one-hundred fold. Nature must be assisted by giving back something for

what had been taken away. He trusted that the experiments now being carried on would be continued for many years.

The Hon. George Swinburne, in seconding the vote of thanks to the Minister, said that the future prosperity of the State depended upon what the men on the land could produce. If they wanted to get everything possible out of their land while maintaining its fertility, they must have education, research and experiments. It all cost money, and there might be doleful times coming when the Treasurer might not have much money and might be inclined to cut down the estimates for this farm. It was necessary for every farmer to demand that the Government shall spend money in research in order that they should be able to get the best out of the land. The prosperity of the State came out of the land. If they were not enthusiastic, or if they did not believe in scientific experiments, they did not believe in what was going to make this State. He was not in Parliament now, and he would say this, that science could do far more for the country than legislation could. He had said it before he went into Parliament, and he said it now. The more

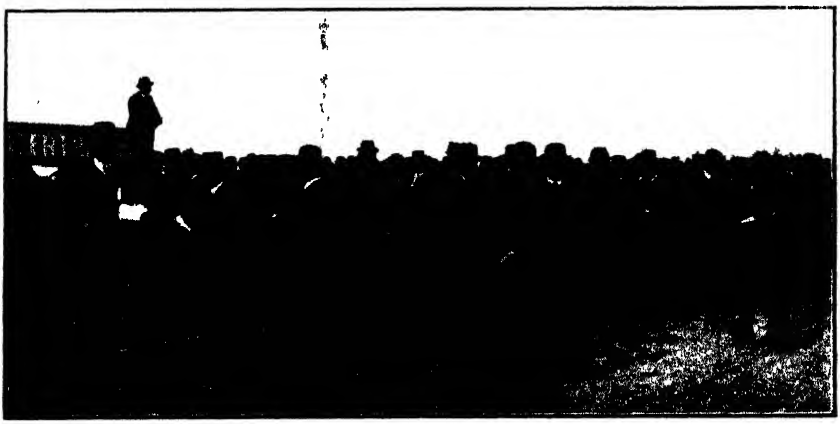


Fig. 4.—Dr. Cameron explaining the Fertilizer Trials.

enthusiasts they had for developing the farming industry the better. In conclusion, he said it behoved the farmers of the State to see that this farm was continued.

Mr. E. A. Dahlenberg (Pimpinio) said that the visit had been an eye-opener to him. It was his first time on the farm, and what he had seen that day on this worn-out land proved that science could do a great deal for the farmer. It showed that science was what they would have to work on in future. The Government should stand to this farm, and the farmers should stand behind the Minister for Agriculture, and demand that the farm be kept on. He would like to see the farm again at harvest time. They had only 4 inches of rain since the crops were put in. It had been a dry season, and if they could do this on 4 inches of rain it was a testimony to good cultivation beforehand, and it would be valuable and interesting to farmers to see how the crops that were looking so well that day would turn out at harvest time. The farmers could do a lot at present, but scientific farming could help them to do more. Soil that was worn out years ago was now growing better crops

than before. He congratulated the Department of Agriculture for undertaking this work, and trusted that the Government would stick to this Research Farm and keep it on, so as to be an education and a lesson to the farmers throughout the State.

Mr. A. Rodgers, M.P (Vectis East), said he did not agree with the statement that farmers were not going to get anything from politics in future to assist agriculture. The House to which he belonged had now before it a very important measure for the establishment of an Agricultural Bureau. He wished to compliment Mr. Graham, and the Ministry upon the interest taken in the matter of agricultural advancement. There was a time when the scientists or theorists, as they were then called, were not welcome, but that time was gone. As far as Victoria was concerned, he would say that the popularity of the Agricultural Department was largely due to the strenuous and ardent work of Dr. Cameron and his staff. The Director had always been ready to come to the seat of trouble, and if there was any difficulty in the district they had no trouble in getting Dr. Cameron, or the members of his staff. He ventured to say that the Director had taken more interest

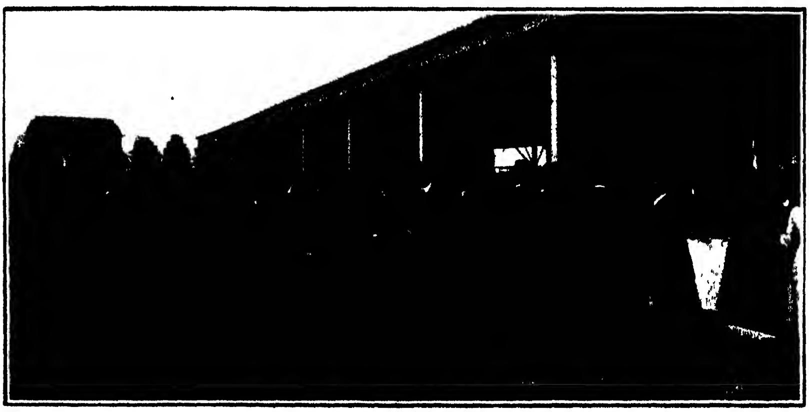


Fig. 5.—Afternoon tea at the Implement Shed.

in agriculture than any scientist before him in Victoria. When the Federal Parliament took on consideration of the Agricultural Bureau Bill it was not with the object of in any way overriding the splendid work carried out by the State Departments, but to co-ordinate with the present system, and to get the best brains the world has got to put at the disposal of the agriculturists.

Mr. G. M. Prendergast, M.L.A., said he looked upon the establishment of a farm of this kind as a novel experiment. He had opinions concerning it he would like to see realized in the future, but was not hopeful. As far as it went at present this farm was of very little value to the practical farmer, and any knowledge that might be gained, after it had been gained, might only benefit the Werribee district.

The Werribee Estate had been Government property for many years, but settlers held aloof from it. He would like to see a realization of the dreams of the gentlemen working upon this land. If it led to a settlement of the estate there would be no one more thankful to Dr. Cameron than he. If the amount of money spent on experiments had

been spent in ploughing the land and making it fit for the agriculturists to go on to, it would soon return money for the expense.

He believed Dr. Cameron, whose education had led him to work in this direction, had certain ideas in his mind. He hoped Mr. Graham, who held the purse, would be able to find the funds to keep it going.

In conclusion, he hoped the farm would be a success, and that the dreams would be realized, but he could not help thinking that, if the Government put some ploughs in, and spent the money that way, and put the people on the land, they would be doing more good for the country.

Dr. Cameron, replying to Mr. Prendergast's remarks, said that a small portion of the farm only had been seen. If they had gone further afield they would have seen that the plough had been put in to some purpose. There were 117 acres of seed wheat for distribution amongst farmers, and 160 acres of oats for hay, and 40 acres of silage crops, that they had not seen. There were also 280 acres of land into which the plough had been this winter. On the question of the benefits

Fig. 6.—Grading Operations at Central Research Farm. Throwing up Banks with Check Banker.

of this farm to settlers who were taking up blocks, he might say that it was in the records of the Lands Department that, of the sixty odd applicants for land on the irrigation blocks on the Werribee Estate, forty-two of them had been induced thereto by what they had seen of the results already achieved on this farm.

On the question as to whether this farm was going to be of any use to any other part of this State, he wished to point out that the rainfall of the Werribee district was the same as that of the Wimmera and Goulburn Valley. The chemical composition and physical character of the soil was the same. There was no part of the State where an experimental farm could be established, the results from which would be more likely to be of general benefit to the State than Werribee. Furthermore, they had the authority of the Agricultural Superintendent, Mr. Richardson, that the results of the wheat breeding and various other research work being undertaken, will be of value to the whole State.

His advice to the farmers of Victoria, which was the same as Mr. Plain, M.L.A., had given the other day after an inspection of the farm,

was to watch the results at Werribee. As a practical farmer in the district, Mr. Plain's opinion on such matters was of high value.

Mr. John Ball (President of the Werribee Agricultural Society) said it gave him very much pleasure to see so many farmers from different parts of the State present that day. He had travelled through the State as much as any man present, and, perhaps, a bit further and oftener than the gentleman who made the remark about the experiments

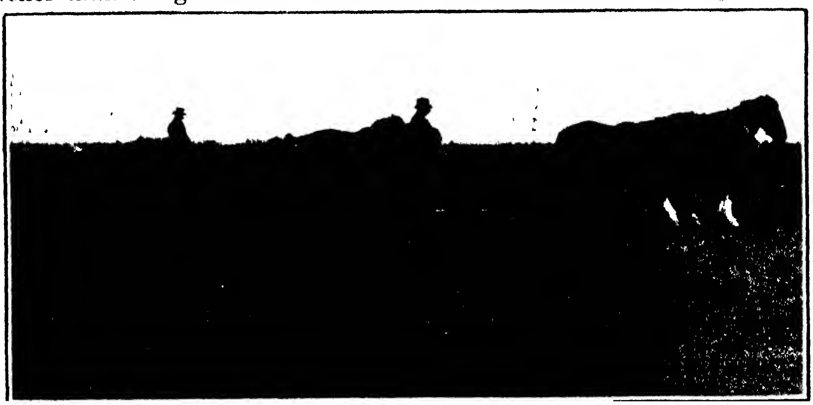


Fig. 7.—Smoothing the Check Banks.

only benefiting the Werribee district. As far as Werribee was concerned, they had had less rain this year than any other part of Victoria. It was the first time he had been on the farm, though his colleagues had been over it a few days ago. They told him when they returned that they were astonished. He had been more than pleased with what he had seen that day. He did not think he had ever seen plots laid out better, and it was a credit to the man who drove the

Fig. 8.—Finishing the Check Banks.

drill. He wished to endorse what had been said about the exhausted character of the land. It was about the worst block, from an agricultural point of view, on the whole of the Werribee estate.

He wished to state that at any time any of those present, or other farmers, wished to visit the farm, if they notified the Werribee Agricultural Society, they would be pleased to drive them out to the farm.

Mr. Graham, in acknowledging the vote of thanks, stated he was very pleased at the large response to the invitation to visit the farm that day. He had told them when they were entering the farm that they were going on to a barren piece of land, and the local farmers had intimated, through Mr. Ball, that it was one of the worst pieces of land in the district. That was one reason why he wanted them to see this farm at the start. He sincerely trusted, and fully hoped, that the ladies and gentlemen present that day would live to see the project carried through as it had been designed. He could assure Mr. Prendergast that the experiments would be for the benefit of the whole of Victoria, and even Australia. The time has come when slip-shod farming had to be stopped, and when the farmer would have to bring science to his assistance.

Regarding the statement that agriculture was on the decline in Victoria, the Minister said that an effort had been made to prove it by comparing a bad season with a good season. A comparison of five year-periods from 1899 to the present would show that there was a steady

Fig. 9.—View showing Disposition of Check Banks.

increase in the area under cultivation, and that the wheat yield had nearly doubled itself in ten years. He had the figures with him, and would quote them now—

From—	Average Acreage under Cultivation. Acres.
1899–1903	3,699,831
1904–1908	4,177 691
1908–1913	5,096,628

From—	Average Wheat Yield. Bushels.
1898–1902	13,472,664
1902–1907	21,530,842
1907–1912	29,810,749

He could quote a number of other figures to show that the dairying industry was progressing in the same way.

The Hon. James Cameron, M.L.A., in proposing a vote of thanks to the men employed on the farm, said that what they had seen that day was a credit to the workmen, and had shown that the men took great

interest in their work. He felt sure that every one on the farm would only be too pleased at all times to show visitors everything that was going on.

Mr. Robert Stanley, said he wished to propose a vote of thanks to Dr. Cameron for the work he had done. They all would agree that under Dr. Cameron's administration live stock had improved. It was only an enthusiast that could make it a success, and that Dr. Cameron was doing.

Dr. Cameron, in reply, said that for himself he required no thanks, but, on behalf of the staff and the men who had worked together to bring the farm to what it was, he thanked them most sincerely. Whatever might happen in the future, this year's work would stand to the credit of Mr. Wilson as long as he lived. Twelve months ago this land had hardly a fence on it. It was now a properly laid out farm divided up into thirty paddocks. As they could readily understand many times throughout the year emergencies had had to be met, and on these occasions the best in Mr. Wilson was always brought out. Things that looked almost impossible to do Mr. Wilson always seemed able to get done. So far as the men on the place were concerned, each and every one of them had worked with a will. On top of all this there had been a keen, never-flagging interest on the part of Mr. Richardson. The design of the experimental work had all been laid out by him.

What they had seen had not been brought about without a great deal of thought and worry, and much midnight oil had been spent over it, too, but throughout there had been a loyal co-operation on the part of the departmental staff for which he was thankful.

He was delighted with the magnificent turn up of farmers that day, and grateful for the many appreciative references that had been made, and he trusted that the hopes that had been expressed as to the benefits that might be expected to follow on the development of the farm would be realized.

CHARACTERISTICS OF GERMAN WHEAT.

Capacity to yield well and at the same time produce flour of superior strength may be compatible qualities, but as a rule these qualities will not be intensified in the same variety of wheat. In the *Monthly Bulletin* (Jan., 1913) of the International Institute of Agriculture the first collective report of the German Experiment Station for Cereal Testing is summarized: "The extensive data resulting from the examination of 26 varieties of wheat showed that local varieties were much superior to intensively selected ones in bread-making properties, while very inferior in yield. Usually, good baking local wheats have the higher gluten content. When mixed with other wheats, the selected highly productive varieties lose their defective properties, and generally produce flour and bread of good colour." If a certain proportion of strong wheat in his flour is necessary to the baker, and if strong wheats characteristically yield less per acre, then wheat of this class should fetch a higher price on the market than soft wheats, and the need for systematic milling and baking tests with the different varieties in order to obtain information on their bread-yielding properties is emphasized.

PREVENTION OF POTATO BLIGHT.

DEPARTMENT OF AGRICULTURE AND TECHNICAL INSTRUCTION FOR IRELAND.

The following is a reprint of a leaflet published by the Department of Agriculture and Technical Instruction for Ireland. It shows the benefit of spraying for "Potato Blight." As will be seen, the experiments extended over a period of six years, and, as we in Victoria have only sprayed for one season, the Irish experience will be of benefit to growers should Irish Blight again break out. With that object in view, the "Leaflet" is now reproduced. It is necessary to bear in mind that the Irish season is the reverse of our own.—EDITOR.

The experience of recent years has conclusively proved that the loss caused by potato blight can be, to a great extent, prevented by spraying—an operation which has now come to be regarded as an essential part of the work connected with the successful cultivation of the potato crop. The reports received by the Department from a large number of districts show that those who take the trouble to carry out the work properly are abundantly rewarded, while those who neglect to spray suffer heavy loss both in the quantity and quality of the crop.

The following Table shows the results of spraying experiments carried out at the Department's Agricultural Stations during the years 1900-5 inclusive:—

—	No. of Tests.	Mixture used	Average Total Yield per Statute Acre. Sprayed.		Average Total Yield per Statute Acre. Unsprayed.		Average Increase per Statute Acre from Spraying.	
			tons	cwt.	tons	cwt.	tons	cwt.
1900	3	Sulphate of copper and lime	10	9	7	16	2	13
	3	Sulphate of copper and washing soda	11	16	7	16	4	0
1901	3	Sulphate of copper and lime	13	18	12	4	1	14
	3	Sulphate of copper and washing soda	14	6	12	4	2	2
1902	3	Sulphate of copper and lime	12	17	10	11	2	6
	3	Sulphate of copper and washing soda	13	6	10	11	2	15
1903	3	Sulphate of copper and lime	12	0	10	18	1	2
	3	Sulphate of copper and washing soda	12	3	10	18	1	5
1904	3	Sulphate of copper and lime	9	11	8	18	0	13
	3	Sulphate of copper and washing soda	10	12	8	18	1	14
1905	3	Sulphate of copper and washing soda	11	6	8	6	3	0
Average	15	Sulphate of copper and lime	11	15	10	1	1	14
	18	Sulphate of copper and washing soda	12	5	9	15	2	10

The Department wish to urge upon all farmers who have not already provided themselves with sprayers, the necessity of at once taking measures to obtain them, and to have their potatoes sprayed in good time.

Agricultural Societies could in many cases purchase horse sprayers or hand machines, and hire them out to members, with great advantage to all concerned.

SPRAYING MIXTURES.

The Department recommend either of the following two mixtures, viz.:—

1. Sulphate of Copper and Washing Soda.*
2. Sulphate of Copper and Lime.

Farmers should insist upon being supplied with pure materials only, and are strongly urged to buy the sulphate of copper and washing soda and to prepare their own mixtures.

PREPARATION OF MIXTURES.

I.—Sulphate of Copper and Washing Soda.

(Burgundy Mixture.)

This mixture is made in the following proportions:—

2 lbs. sulphate of copper of 98 per cent. purity.
$2\frac{1}{2}$ lbs. washing soda of 98 per cent. purity.
10 gallons clean water.

In most cases farmers use a paraffin barrel of forty gallons capacity for preparing the mixture. For this amount four times the above quantities will be required, namely:—

8 lbs. sulphate of copper.
10 lbs. washing soda.
40 gallons water.

The preparation of the mixture should be set about in the following manner:—

Thoroughly wash out the barrel and pour into it thirty-five gallons of clean water. The 8 lbs. of sulphate of copper should then be put into a canvas bag or tied up in a piece of canvas cloth, and put into and moved about in the water in the barrel until the crystals are dissolved. This operation can be more quickly accomplished if the crystals of sulphate of copper have been previously ground.

Having prepared the solution of sulphate of copper, next dissolve the 10 lbs. of washing soda in five gallons of water in a separate vessel. Then pour the washing soda solution slowly into the copper sulphate solution in the barrel, stirring continuously. The mixture should then be ready for use.

Note.—*Even when the above conditions are accurately carried out the mixture may not give the best results, owing to differences in the strength of the sulphate of copper and of the washing soda. Those who wish to get the best results should dip a piece of blue litmus paper in the prepared mixture. If the paper becomes red, more washing soda should be dissolved and added in small quantities at a time to the preparation, and with continuous stirring, until a fresh piece of paper dipped in the mixture remains blue. One pennyworth of litmus paper, which may be obtained from any chemist, is sufficient for a large number of tests.*

* Washing soda is also known as carbonate of soda.

II.—Sulphate of Copper and Lime.

(Bordeaux Mixture.)

This mixture is made in the following proportions:—

2 lbs. sulphate of copper of 98 per cent. purity.
1 lb. unslaked lime of the best quality.
10 gallons clean water.

Or, if a forty-gallon paraffin barrel of the mixture is to be prepared, four times the above quantities will be required, namely:—

8 lbs. sulphate of copper.
4 lbs. lime.
40 gallons of water.

To prepare this mixture proceed to dissolve the sulphate of copper exactly as has been described for No. 1 Mixture, viz., dissolve the 8 lbs. of sulphate of copper in thirty-five gallons of water in the paraffin barrel.

Having prepared the solution of sulphate of copper, next prepare the milk of lime. For this purpose procure a wooden tub holding five gallons, and also a bucket. Put into the bucket 4 lbs. of good freshly-burned unslaked lime. Sprinkle it with sufficient water to change it to a powder. Then add sufficient water to fill the bucket. This, when it has been well stirred up, will make a thin milkly fluid. Pour this into the tub, and add thereto sufficient water to cool the mixture and to bring the quantity up to five gallons. After being thoroughly stirred it may be slowly poured through a fine sieve, such as is usually sold with the spraying machines, into the barrel containing the copper sulphate solution. The contents of the barrel should be continuously stirred while the milk of lime is being added to it.

The mixture should then be of a bluish colour and ready for use, but in order to secure the best results the blue litmus paper test should also be applied to it. If the paper turns red a further quantity of milk of lime should be prepared, and added in small quantities at a time to the mixture until fresh paper put into the solution remains blue. It should then be applied with as little delay as possible, and the mixture should be well stirred each time before the sprayer is filled.

GENERAL OBSERVATIONS.

The following points should be kept in mind:—

1. Sulphate of copper dissolves very slowly in cold water. If at all convenient it will be found better to dissolve the material in hot water, and then add the required quantity of cold water. The same remarks apply to washing soda.

2. There is no harm in dissolving sulphate of copper and washing soda or lime in separate vessels and holding the solutions over for several days, but once the solutions are mixed together the mixture should be applied IMMEDIATELY. If held over even for one day it deteriorates rapidly, and is then much more readily washed off the plants by rain.

3. All the vessels coming in contact with the sulphate of copper should be of wood and not of metal.

4. It will save much time and annoyance if every possible precaution is taken to have the mixture free from grit, or any other foreign matter

which would stop the nozzles of the sprayers. For this reason the water used should be strained through a piece of canvas or other suitable cloth.

5. The milk of lime or washing soda solution should always be poured into the sulphate of copper, and not conversely.

6. Effective stirring in every stage of the operation is essential to success.

7. Sulphate of copper is poisonous, therefore the vessels in which sulphate of copper mixtures have been prepared should not afterwards be used to hold food or water for consumption.

8. The addition of soot, treacle, or other materials to spraying mixtures is not recommended.

Advantages of using the Sulphate of Copper and Washing Soda Mixture.

The Department recommend the use of washing soda in preference to lime for the following reasons:—

1. The spraying mixture adheres longer to the foliage of the plants, and is not so readily washed off by rain.
2. The mixture can be more easily prepared.
3. The nozzles of the machine are not so liable to become stopped with grit or refuse material. If washing soda is used and the mixture is carefully made, there should be no sediment.

APPLICATION OF THE MIXTURE.

Spraying should be done before signs of disease are observed in the crop. It is therefore desirable that the first dressing should be applied from the middle to the end of June, before the disease appears. The actual date of the first spraying will depend upon the season, *i.e.*, the prospects of an early appearance of blight, and upon the development of the crop. A second spraying should be given about two or three weeks after the first application, as in that interval a large quantity of foliage will have developed, and a considerable portion of the original dressing may possibly have been washed off by rain. A third dressing may sometimes be advisable, especially in a wet season.

The best results can only be obtained when a sufficiently high pressure is maintained in the sprayer for the mixture to be forced out as a very fine spray; by this means the foliage can be completely covered, and there is little waste through the mixture falling on the ground.

Spraying should be done during dry weather. If rain should fall heavily soon after spraying, examine the foliage, and if the mixture has been washed off to a considerable extent, spray again. Spraying should be suspended when it is raining.

Quantity per Acre.

The quantity of the mixture to be applied per acre for one spraying is approximately as follows:—

For an average crop of potatoes with fully-developed foliage, about 100 gallons per statute acre, equal to 162 gallons per Irish acre. For a crop of potatoes with a small amount of foliage, a somewhat less quantity will suffice.

The quantity of raw materials required to spray properly one statute acre with 100 gallons of liquid is as follows:—

20 lbs. sulphate of copper.
25 lbs. washing soda.

45 lbs. Total.

CARE OF SPRAYER.

The external bearings of the spraying machine should be frequently oiled, but care should be taken not to let any of the oil get upon the rubber parts of the machine. The machine should be well washed out with water immediately after use, thoroughly cleaned and dried and the pump oiled before being put away.

DEPARTMENT OF AGRICULTURE AND
TECHNICAL INSTRUCTION FOR IRELAND,
April, 1912.

THE CARE OF CREAM.

For the factory manager to turn out a first grade butter he requires the help of the farmer. The cream must be delivered in the best order possible, and some useful reminders in handling cream are supplied by the *New Zealand Jour. of Agric.* Cleanliness in the dairy is an essential condition. Cream cans are returned washed, but it is very necessary that they should be thoroughly cleansed and scalded again at the farm before use. For separating, a special room should be provided, at least 30 yards to windward of the milking shed, have a concrete floor, be provided with good drainage, well ventilated, and have a good supply of water. The milk should be separated as soon as possible, and while the animal heat is in the milk. The cream should at once be cooled to the lowest possible temperature; and, as the water required is small, this should present no serious difficulty. Under no circumstances should cream from one skimming be mixed with cream from another skimming unless it has first been well cooled. The most unsatisfactory of all suppliers is the man who places the cream can under the separator and does not touch it again till it has received the cream from several milkings. This is a most potent cause of defects. It is also advisable to provide a trough of cold water in which to stand the cream cans, and the cream should be occasionally stirred to reduce the temperature and break up the froth which collects on the surface. The cans should be covered with a light cheese-cloth to keep out dust, and this cloth should be washed and dipped in boiling water each time it is used. The separator should be cleaned by dismantling each time after use, scalded and placed in a sweet atmosphere until again required. The cans should be protected from sun while waiting for the factory cart or during transit. Reference has been made in these notes to the desirability of paying for cream according to condition, and it is said that in New Zealand the general adoption of this system, which will do much to raise the quality of butter exports, is near at hand. It is not stated whether the grading of cream will be compulsory.

STANDARD TEST COWS.

QUARTERLY RETURN OF CERTIFICATED STANDARD COWS FOR THE PERIOD ENDED 30th SEPTEMBER, 1913.

Since the First Annual Report on the Government Certification of Standard Cows, which appeared in the September issue of the *Journal* of this Department, fourteen cows have completed the term required by the regulations. Of this number eleven have attained the standard, and certificates in respect of such will, in due course, issue.

The following are the individual returns:—

F. CURNICK, Malvern (JERSEY).

Completed since last Report, 2; Certificated, 2.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No of Days in Test	Weight of Milk Last Day of Test	Weight of Milk	Average Test.	Butter Fat	Estimated Weight of Butter.
					lbs	lbs		lbs.	lbs.
Peerless of Melrose III...	2817	9.10 12	20 10 12*	273	13¾	6,352½	5·09	323½	368¾
Waverley Lass .	2793	4.10.12	20.10 12*	273	14½	6,788¼	4·86	329¾	376

* Weights not available sooner.

P. E. KEAM, Heidelberg (JERSEY).

Completed since last Report, 4; Certificated, 1.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test	No of Days in Test	Weight of Milk Last Day of Test	Weight of Milk.	Average Test.	Butter Fat	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
White Star .. .	2795	6.12 12	13 12.12	273	5	4,174¾	6·13	256¼	292¼

C. GORDON LYON, Heidelberg (JERSEY).

Completed since last Report, 2; Certificated, 2.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No of Days in Test	Weight of Milk Last Day of Test	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
†Silver Audrey ..	1378	11.12.12	18.12.12	273	14¼	4,962¼	5·3	261¼	298
†Silver Pride ..	1387	17.12.12	24.12.12	273	15¾	4,950	4.7	232½	265

† Heifer.

DEPARTMENT OF AGRICULTURE (RED POLLED).

Completed since last Report, 5; Certificated, 5.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk.	Average Test.	Butter Fat	Estimated Weight of Butter.
					lbs.	lbs		lbs.	lbs.
†Birdseye ..	Not yet allotted	3.10.12	10.10.12	273	8	4,351½	5 75	250½	285½
Cuba	„	7.10.12	14.10.12	244	2	6,288¾	4·03	269	306¾
Kentucky	„	18.10 12	25.10.12	266	5	6,249¼	4 09	256	291¾
Egypta	„	28.10.12	4.11.12	273	19	6,304¼	4·27	269½	307
†Goldleaf ..	„	5.11 12	12.11 12	273	14	6,437¼	4·79	308¼	351¼

† Heifer.

F. J. STANSMORE, Pomborneit (AYRSHIRE).

Completed since last Report, 1; Certificated, 1.

Name of Standard Cow.	Herd Book No	Date of Calving	Date of Entry to Test.	No of Days in Test.	Weight of Milk Last Day of Test	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
Kathleen of Gleneira	1732	18.12.12	25.12.12	273	11	6 003½	3 75	225½	256¾

Four additional herds have been entered during the quarter, making a total of nineteen, which are now under supervision. The following are the herds referred to:—

——	Breed.	Cows in Test.	Probable Number.
C. D. Lloyd, "Urandaline," Gleneira road, Caulfield	Jersey	2	4
A. W. Jones, St. Albans	Jersey	3	6
J. G. Bjorksten, "Mayfield," Seymour	Ayrshire	13	20
Wood Bros., Gleneira road, Caulfield	Jersey	2	2

On the evening of 22nd September, a meeting of the owners of all herds, which were under the test, was held to discuss the regulations and certain alterations which, during the progress of the year, had been suggested. All participating in the scheme were represented, and considerable enthusiasm was shown in the results achieved to date.

It was found that, so far as both the herd-owners and the Department were concerned, the regulations had operated in a satisfactory manner. Two important points were carefully considered, namely, the raising of the standard and the branding of calves the progeny of certificated cows. It was unanimously decided to suggest that the standard under Regulation 11 should be raised; and after considerable discussion, it was further agreed that the regulation should be amended to read:—

"(*a*) in the case of cows commencing their first lactation period, and being then under three years of age, 175 lbs butter fat;

"(*b*) in the case of cows commencing their first lactation period, and being then over three years of age, 200 lbs butter fat;

"(*c*) in the case of cows commencing their second lactation period, and being then under four years of age, 200 lbs. butter fat;

"(*d*) in the case of cows commencing their third, or any subsequent lactation period, or being then over four years of age, 250 lbs.* butter fat."

In respect of the branding of calves, it was agreed that, for the future, all calves, the progeny of cows entered for certification, should be suitably branded or tattooed as soon as possible after birth in order to insure identification. In order to give effect to this, Regulation 4 will be amended to read:—

"Any cow entered for certification, and any calf the progeny of such cow, may be branded in such manner as to insure identification, and all standard cows will be marked on the inside of an ear with the Government tattoo mark, and an identification number."

*The suggestion of the meeting of herd-owners was that the standard in this sub-class should be raised to 275 lbs. butter fat. The Minister of Agriculture, however, fixed the standard at 250 lbs.

THE BENEFIT OF LEGUMES—

It is a well known fact that a vigorous leguminous crop such as peas or clover enriches the land in nitrogen, and that another crop, say wheat or oats, following in rotation will benefit from the nitrogen residues. Recent investigations show, however, that the cereal may derive benefit from the legume even when both are growing at the same time. In the *Jour. Agric. Sci.,* vol. 3, experiments are described bearing this inference. Oats were grown in quartz sand in small pots placed in larger pots also filled with quartz sand, but growing peas. The inner pots thus grew oats only, and the large outer pots peas only, and in both cases all the necessary plant foods were added except nitrogen. The inner pots were of two kinds. Where they were of glazed ware the oats showed the effects of nitrogen hunger, but where they were of the ordinary porous pattern the oats grew vigorously. In the latter case it is believed that soluble nitrogenous matters diffused through the inner pot from the peas growing outside. Confirmation of these results under field conditions seems to be conveyed in a recent bulletin issued from Cornell University. Here also the legume seemed to supply available nitrogen to grass or oats growing along with it at the same time. Thus timothy grown with lucerne contained in its dry matter 15.56 per cent. of crude protein, but without lucerne it had 12.75 per cent. Similar results were got from timothy with and without clover, while oats also contained more protein grown in a mixture than as a pure crop. While these results point to an earlier benefit from the legume upon other crops than had been supposed, it would be insufficient in practice to grow, say, clover with oats instead of giving nitrogenous manure where the oats require this. The greatest benefit from a leguminous crop will be found not upon the crop growing at the same time, but upon the next crop which follows after it is harvested or ploughed in.

SPARROVALE FARM.

By J. S. McFadzean, Senior Dairy Supervisor.

In the *Journal of Agriculture* for August, 1907, under the heading of "A Farm in the Making," an account was given of the reclamation work which the Geelong Harbor Trust had then entered upon in regard to the swamp lands lying adjacent to the Barwon River, between Geelong and the sea. As the progress made since then has demonstrated the practicability of a scheme, which, from a dairying stand-point, was then supposed to be somewhat problematical, the facts relating thereto will be found interesting. In an undertaking such as this, which necessitates years of work before a stage of progress is attained that can be regarded as definite, it is almost certain that some difficulty will arise that will call for more than ordinary confidence on the part of the management if it is to be faced with equanimity; and the present instance is a striking example of this. There were problems here confronting the Trust when it entered upon the dairy-farming part of the scheme, which time alone could decide; but these have been solved, unforseen difficulties have been surmounted, and reverses have been met with determination; till now the Trust, and its farm manager, Mr. Baird, can look back at these several uphill battles, and feel that success is assured.

The wisdom of the Trust's Commissioners embarking on this swamp improvement work was questioned by many; but outside those directly in touch with the Harbor Trust's work there were very few who had a grasp of the situation. The actual reclamation of the land was a comparatively simple matter, and, if carried out, it was easy to forsee that the grazing value of the area dealt with would be immeasurably increased. Cultivation, however, would require much more work to be done than was necessary for grazing; and whether the cost of clearing, draining, breaking up, and grading would be repaid by cropping was a matter not so easily estimated. Still no one could dispute that, if lucerne could be grown on these flats successfully, their value, from a dairying stand-point, would be greatly enhanced; and the results which have been attained in this direction are beyond the most optimistic anticipation. As the land was drained and broken up, maize, oats, and barley were each tried as first crops; and English barley has proved the best for this purpose. In a previous report it was mentioned that over some portions of the area sown the first crop of maize had not grown well, and this was attributed to excess of salt in those places. Later trials showed that where English barley was used as a first crop the portion of the area remaining unproductive from this cause was invariably less than when either oats or maize was sown, showing that, so far as salt in the soil was to be considered, the barley was the hardier crop. Even with barley there has been as much as a 10 per cent. reduction from the possible results, owing to the presence of salty patches; but under irrigation these places grow smaller after each flooding, and on the land first broken up, and now established in lucerne, there is no sign of these unfertile patches.

After barley, either oats or maize is sown; and, following on this, the land is prepared for lucerne. The barley crops are sown as soon after

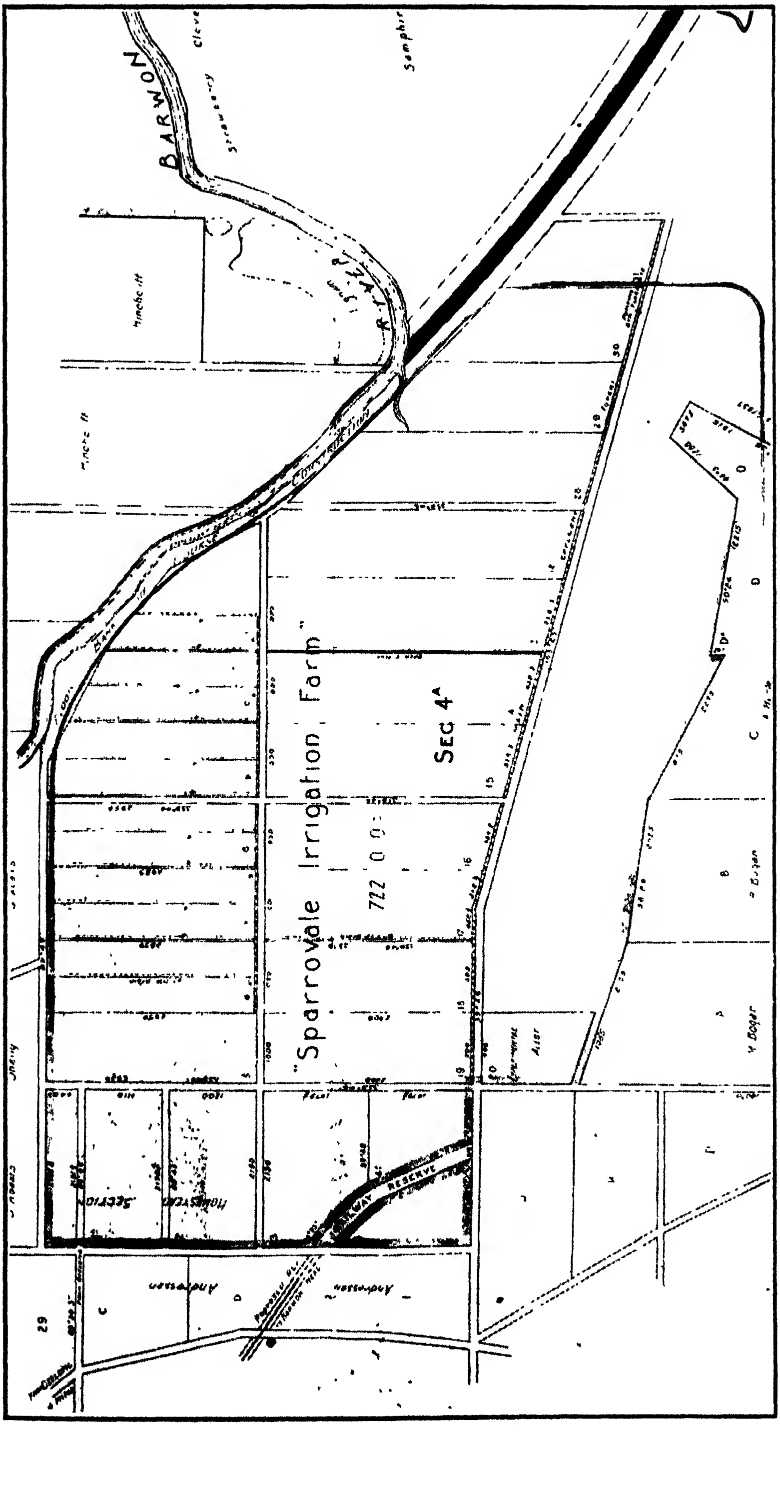


Fig. 1.—Plan of Sparrovale Farm.

April as possible, as the early-sown crops have always given the best results; and, under favorable weather conditions a return of at least 35 bushels per acre is expected. With oats a 2-ton hay crop is looked for; and when the lucerne has reached well into its second year, over 6 tons of hay per acre per annum is possible from it. Two and a half tons of lucerne hay was the actual weight cut from a measured acre in one instance, and in the warmer weather 5 tons of green lucerne per acre is looked on as the average cutting from a second-season crop. The Peruvian, Turkestan, and French Province varieties have all been given trial. The last-named has proved rather the slowest grower during its first year; the Turkestan and Peruvian being about equally prolific during that time; but, once established, the French Province has made the best headway, and the results obtained from this variety warrant the statement that 8 tons of hay per year can be cut from an established crop of French Province lucerne under favorable conditions. In the colder months the Peruvian has made by far the best growth; and in the early spring the French Province is the slowest to move; but as soon as the warmer weather sets in this latter makes up for lost time, and, for the year, will give the heaviest return in fodder; the drier years being especially conducive to its prolificacy. The amount of seed used is about the same with all varieties, viz., 12 lbs. per acre; but the greatest care is always taken to have the land worked down into a condition that will give the seed every chance to grow.

The whole of these flats on Sparrovale can be watered from the river at a running cost of 1s. per acre each watering. As a rule three waterings are all that is necessary, but five would carry the lucerne through the driest year; and, as about 5 inches of water at a time is sufficient to carry the crop through to the next cutting, the cost of the water would approximate 2s. 6d. per acre-foot. With this land secure from floods a yield of 6 tons of lucerne hay per acre would be a very conservative estimate, and, placing its value even as low as £3 5s. per ton, the return possible is sufficiently satisfactory to allow the most pessimistic critic to answer with safety the question whether this land is worth reclaiming. When inspected in July of this year there were 173½ acres in barley, 105 acres in oats, and 99½ acres in lucerne; while 25 acres of barley and 47 of lucerne were yet to be sown. All the crops above ground were growing well, and the hay paddocks were being grazed off in rotation, and, taking the crops, stock, and general appearance of the Sparrovale farm throughout as it then stood, no dairy farmer could desire a more prosperous outlook.

During the initial experiments that were made here to prove that this land possessed the inherent qualities which would warrant its reclamation being made absolute, there were two occasions on which the river overflowed the levee bank, and, on the water receding, it left the farm lands smothered with silt. The first of these misfortunes occurred in August, 1909, and the second in September, 1911. Only those who have had a similar experience can realize what it means to have cultivation and grazing land under water for days on this lower Barwon land, for the deposit left by these floods is a thick, slimy mud. This, on drying, usually breaks into hard cakes several inches across, taking months to weather down; consequently a lot of time will always

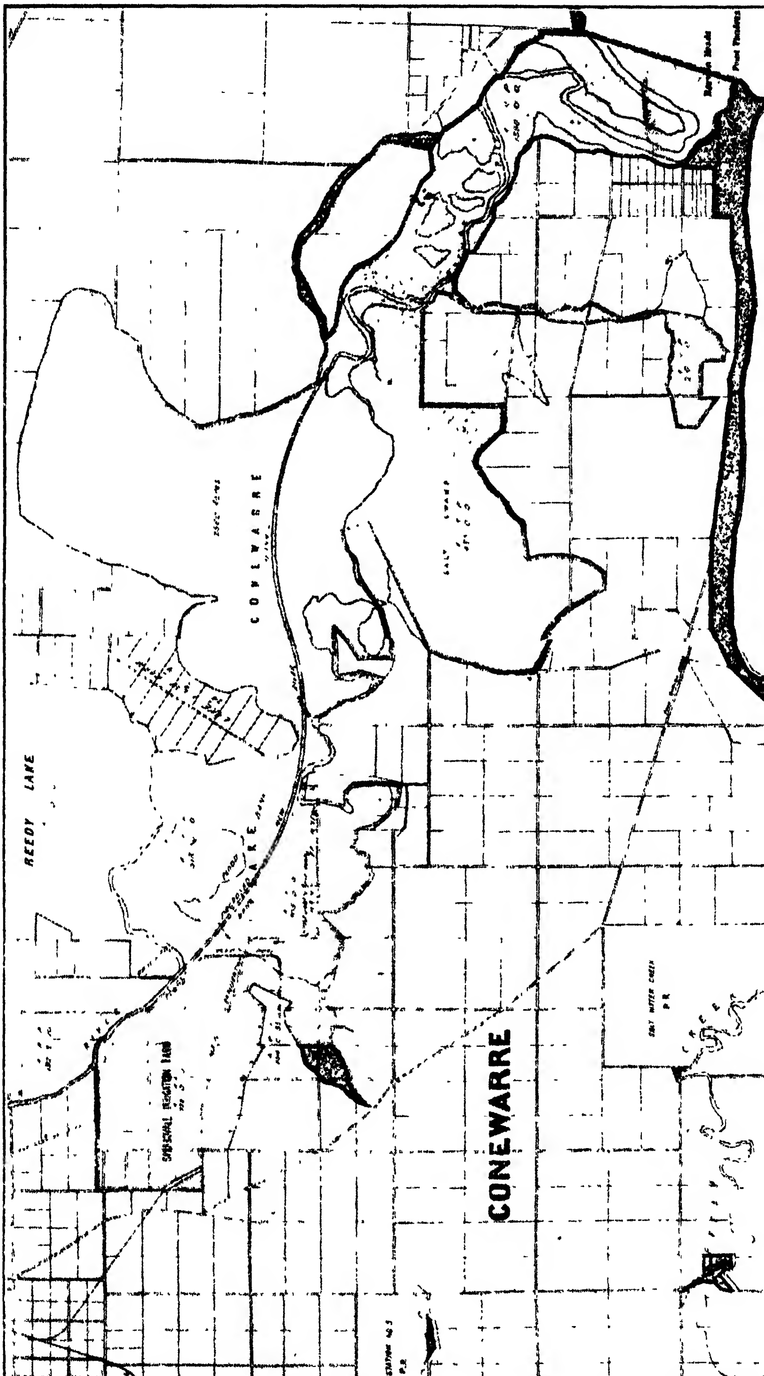


Fig. 2.—Lower Barwon Swamp Lands.

elapse before the grass will again form a sward, as fresh surface roots have to form before the stalks will properly develop. To have crops and grass land buried in mud, and the cultivation land soaked through in these early spring months, means the loss of a whole season's fodder, to say nothing of the labour expended up to that stage; and that the Sparrovale farm has successfully weathered two such calamities within six years is in itself strong evidence of the possibilities which await it when this reclamation work is completed, which, so far as can at present be seen, should be about the close of 1914.

The levee bank surrounding Sparrovale is now only sufficient to protect the farm from ordinary floods, and, in order to exclude what are known as big floods, the bank will require to be raised at least another 6 feet higher. It is now 9 feet above sea-level; and, as 13 feet is the limit of the highest flood recorded in this locality, the Trust feel that with a bank 2 feet above this the farm may be considered out of danger.

Fig. 3.—New Channel across Island Bend.

One part of the reclamation scheme which the Trust has always had in mind, and which was set down for attention as soon as Sparrovale was completed, was the opening up of a new course for the river to Lake Connewarre, across a bend which it now takes, south of Reedy Lake, forming what is known as "The Island," on the eastern boundary of the farm. Making a detour of more than half a circle, the river here takes in an area of 518 acres of land which it overflows with every freshet. This circuitous course is also largely responsible for much water being forced at such times across the opposite bank of the river into Reedy Lake, covering the 1,750 acres of grazing land contained therein. As shown in Fig. 3 the opening up of this new river-channel is now in progress. The earth as it is removed by the "Grab" crane is being trucked direct to the levee bank at the southern boundary of the farm. (See plan Fig. 1.) This cut is now some 26 feet wide, or about one-fifth of the breadth the channel will be when completed, while

the length of the cutting necessary is about 120 chains; and the water depth therein is to be 6 feet. The river at the top of this channel is some 20 feet deep, and it is anticipated that the scour will soon deepen this channel when the river is turned into it. With the completion of this cutting it is estimated that the material removed will have raised the levee bank round the whole of the Sparrovale river frontage to the height required to render the farm lands proof against flooding thereafter.

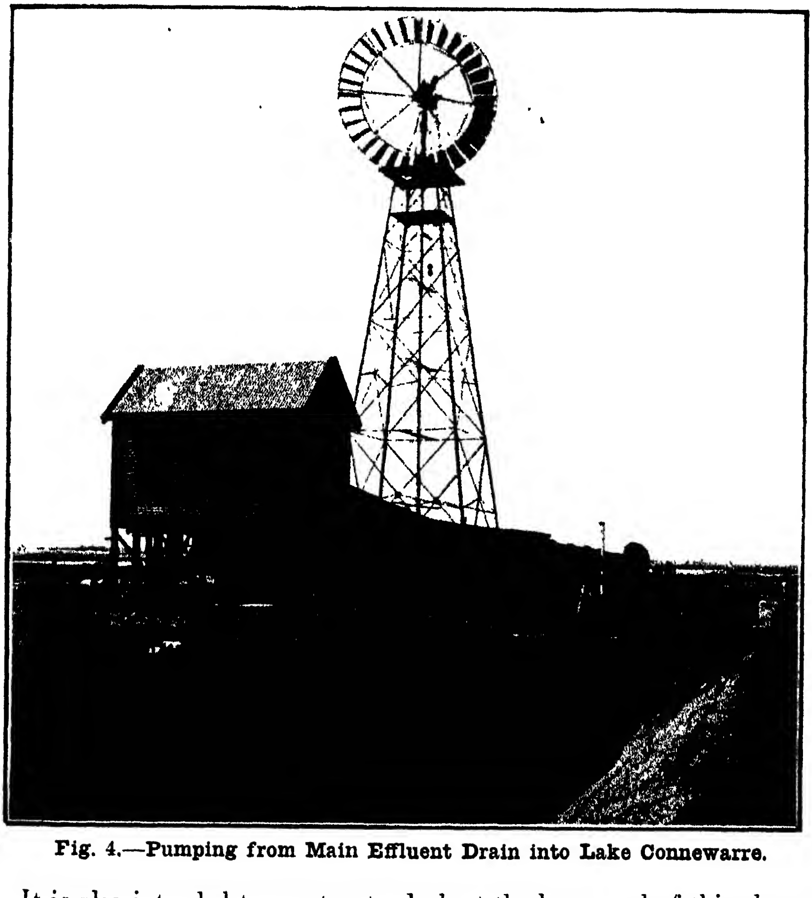


Fig. 4.—Pumping from Main Effluent Drain into Lake Connewarre.

It is also intended to construct a lock at the lower end of this channel to keep back the sea water which, through it, would otherwise have access to the river. As formerly mentioned (*Journal of Agriculture,* August, 1908) the tidal flow through Connewarre is now kept out of the river by a recently built, though somewhat temporary, breakwater at Reedy Lake, thereby superseding the original and substantial stone structure some 4 miles further up, where the railway line crosses the river, which was built in 1841. It is, therefore, essential that, in opening up this new channel for the river, provision should be made for maintaining the exclusion of the salt water; as, besides the commercial value of the river as represented in its use for stock-watering

and irrigation purposes, this fresh water is a valuable asset to the many tanners, fellmongers, and factory firms carrying on business on the river side, and, to give the sea water access to this part of the river now, would be a serious drawback to these trades.

The windmill and pumping plant, shown in Fig. 4, is situated at the end of the main effluent drain which, by means of the underground drainage system established here (and described in 1908), collects all surplus water from Sparrovale and delivers it to this point. Looking seawards from the farm the plant stands to the right of the new channel, and the water of Conewarre can be seen in the picture above the bank over which the drainage from the effluent is pumped. This combined windmill and oil-engine pumping plant can remove over 3,000 gallons of water per minute to the lake beyond.

Fig. 5.—Piggeries, Barn, and Stabling.

Reference to the plans of these swamp lands (Fig. 2) will show that the levee bank, running down from the river and channel, is continued south of the pumping plant for some distance, and then it turns due west into "Hurley's" block, which is part of "The Wyllies" farm. This portion of the levee bank is known as the "Lake" bank, and besides protecting the Sparrovale lands on this side from the waters of Lake Conewarre, it also safeguards some 160 acres of "The Wyllies" which is owned by the Harbor Trust, and leased to Mr. Eric McKenzie.

In August of last year there was a flood in the river which the levee bank held safely, but, twenty-four hours after it had reached its limit opposite the farm, and when it had actually fallen some 6 inches on the bank at that point, the water in passing through Conewarre to the ocean, was met by a spring tide and heavy sea which prevented it getting away. A strong south-westerly wind caused this water to overlap the lake bank, and, before any danger was thought of from that quarter, some 100 acres of Sparrovale and the Wyllies were under water. The overflow was soon checked by the farm staff when discovered, but it

took three days' pumping to remove the water, and it is this bank which, in consequence, is being given first attention to in the disposal of the earth from the new channel, to strengthen it against any such recurrence arising from a combination of the elements.

Turning from the reclamation work towards the homestead the cultivation work is seen making satisfactory progress. Ploughing, breaking down, grading, sowing, &c., is all done by the students, and these young farmers are making good use of their opportunities here, and are turning out very creditable work in every section. As the land is brought under cultivation, the adjoining roadways are being planted with shelter trees, and this has been done with the main farm road well on towards the river. Those first planted out closer up to the homestead have made good progress, and already add considerably to the appearance of the farm, as well as affording both shelter and shade.

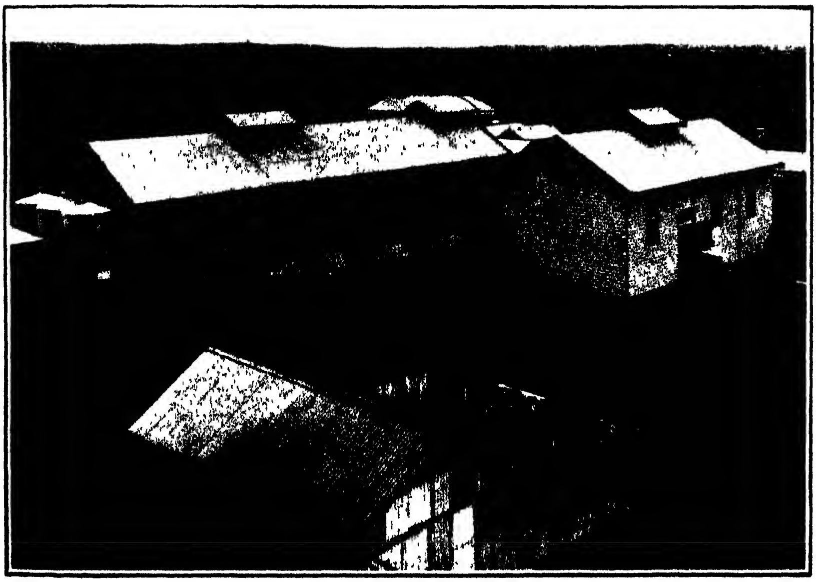


Fig. 6.—Stabling and Stallion Yards.

Some photographs of the farm steading, reproduced here, will give an idea of how it is laid out. Coming up from the lucerne paddocks along the northern boundary the bull pens and yards are the first of the buildings; next to these are the piggeries; then the stallion yards, the stabling, the smithy and implement shedding, and beyond this the garden and manager's residence lie in this order. To the left or south of the stallion yards stands the barn and silo shedding, which encloses the two 350-ton silos, and where the chaffing, grinding, and mixing of the feed is done. Looking from the door on the third floor of the silo shed, in a north-westerly direction, Geelong is seen in the distance; and closer in, and above the roof of the stabling, the engine and trucks engaged in distributing the pipes for the Geelong sewering scheme come under notice. The door on the opposite side of this building overlooks the milking shed, behind which are the calf pens and poultry runs, sur-

rounded by young trees; while through the branches of the pines the workmen's cottages may be seen, and the back of the dairy buildings is at the right of this picture. As will be observed from this and the interior views, the milking shed is a well-lighted and substantial, and yet economically built structure. It is 108 feet long by 30 feet wide, having a double row of 25 bails, with feed gangway between. It is 14 feet high over the gangway, with the shed roofing sloping from 10 feet to 7 feet from the ground. The tramway which conveys the fodder to the milking shed also carries the milk from the shed to the dairy, where it is raised by a hoist to the vat above the cooler. In Fig. 10 the feed truck is seen standing on the turntable; and this roadway also carries a line of rail over the rise past the calf pens to the feeding sheds. The next picture (Fig. 11) shows the front of the dairy, the refrigerating chamber being in the lower part of the brick building.

Fig. 7.—Overlooking the Milking Shed.

The milk, from the vat above the hoist, passes down over two brine coolers in succession, which allows of a 9-ft. fall for aeration; thereby both eliminating all risk of fodder odors remaining in the milk, and reducing it to the required low temperature before forwarding it from the farm. Below the dairy buildings the engine shed and upper and lower stabling are situated. Trees shelter the approach to the dairy; while at each side of the roadway bufflalo grass has been planted, and has grown into a thick mat, and by this means, as far as possible, dust is prevented from being blown about near the dairy. Across a double roadway, which is also protected by trees and grass borders, and opposite to the last-mentioned line of buildings, are the students' dining-room, the employés' quarters, and implement sheds (Fig. 12), with the smithy and wheelwright's shop at the bottom of this quadrangle; and the tram line from the river runs to this latter shedding. Also surrounded by

shelter trees and small lawns, the office buildings, students' quarters, and manager's residence, are grouped between the employés' quarters and the road, which forms the western boundary of the farm. Altogether a better arranged home steading it would be hard to find.

In the description of this farm in the 1908 article reference was made to the necessity for the Trust possessing high land adjacent to that which it was proposed to reclaim to be used as a working base. The site of the Sparrovale home steading was actually the only high ground owned by the Trust at the outset, and the buildings thereon were planned so that from them the whole of Sparrovale could be worked when ultimately brought under cultivation. For similar purposes the "Lake View" and "The Wyllies" farms were purchased; as each of these is favorably situated as a base for reclaiming and working exten-

Fig. 8.—Interior of Milking Shed, looking East.

sive areas of swamp land around it. Looking at the plan of Sparrovale, as shown in Fig. 1, the homestead buildings and yards occupy blocks 1 and 1A; No. 2 is the grazing paddock for the pure herd; part of No. 3 is in oats, and the rest in barley; No. 5 was being broken up; Nos. 4, 6, and 18 are in oats; 7, 8, 9, 10, 11 are the lucerne blocks, and 14, 15, 16, 17, and 19 are in barley. The other plan (Fig. 2) shows the situation of the whole of these lower Barwon swamp lands from the old breakwater to the sea. To the west of them, and along the south runs the road to the well known holiday resorts and fishing grounds of Bream Creek and Barwon Heads, while to the north-east lies the Queenscliffe-road.

Dairying is the most profitable branch of agriculture that such a large area of irrigable land within 50 miles of Melbourne could be used for, more especially as the situation and train service allow of the fresh

milk being forwarded to the city twice daily. During the autumn and winter months the city retailers frequently have difficulty in obtaining a full supply of milk; and those who can uphold their daily yield from the herd within reasonable range of a stated average quantity during these months find no difficulty in placing their milk at full market rates the year through. To keep up a regular supply through these colder months necessitates extra care being given to the cows, and the Trust has made full provision for the welfare of the stock at all seasons. The cultivation land will produce the fodder; the silos and barn allow for its conservation; there is a good water supply—pumped from the Barwon River and piped to troughs all through the farm; and there are feeding sheds and shelter belts for the further comfort of the cattle. The one other factor to successful dairying lies in having good cows, and here also the management of the farm has been systematic.

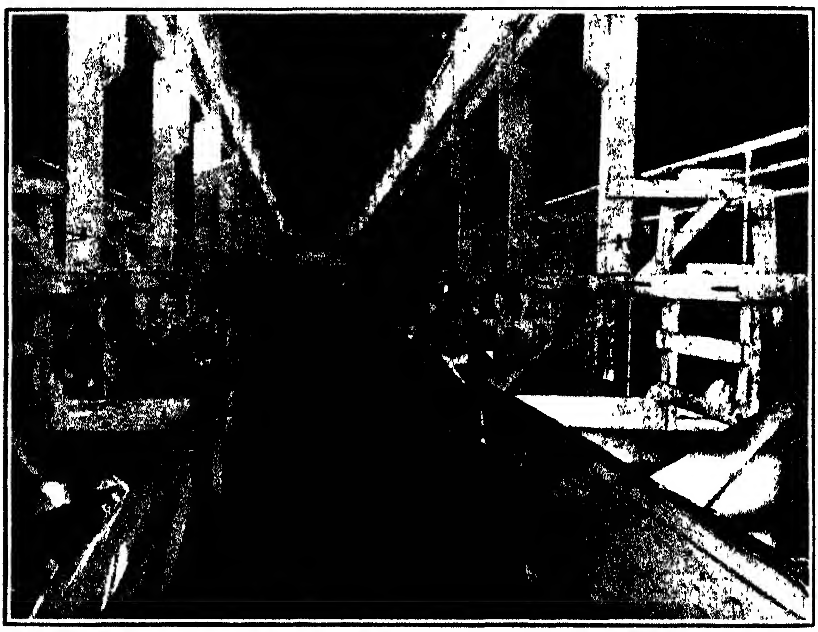


Fig. 9.—Interior of Milking Shed, looking West.

It was mentioned in the 1908 report that pedigreed Ayrshire bulls selected from good milking strains were in use, and that a few high-class heifers of this breed had also been purchased with the intention of later on building up a pure herd. The general herd was bought in lines of springing heifers as procurable; and a system of selecting the best from these was initiated. It was soon apparent that the number of really profitable cows obtainable by purchasing in the open market was but a very small percentage of the whole; and, instead of increasing the herd, it was gradually reduced in number by culling, and it is now being kept up to its present numerical standard solely by heifers bred on the farm.

There are many obstacles to the speedy establishment of a large herd of profitable milking stock even by breeding, and especially where

the milk, largely required for a regular trade supply, limits the amount available for calf raising. At least one year will pass while the quality of each cow is being determined, and some four or five years will elapse before it can be ascertained which of the bulls are throwing the best milking stock. There is then the possibility of some misfortune causing the loss of a very valuable bull, perhaps even before his quality has been discovered and made best use of; and, as every dairyman knows only too well, if a cow meets with an accident it is more often a good animal that suffers than one which could better be spared. In some cases everything may go smoothly, and the herd may be quickly improved in quality, while the owner takes all the credit to himself for his good judgment and knowledge of stock, but more often the grading up of a herd is a work beset with many difficulties, and productive of many disappointments.

Fig. 10.—Tramway to Feeding Shed, Milking Shed, and Dairy.

In the establishment of the Sparrovale herd the manager, Mr. Baird, has by consistent attention to detail achieved most satisfactory results to date. From heifers, the breeding and milking qualities of which were unknown, he has, by systematic culling and breeding, built up as creditable a herd of crossbred cows of this number as I have seen; and, with the breeding and milk-producing capabilities of all the stock now well under observation, each year's work must, in the future, show still further progress. The herd is divided into three sections. At the date of inspection the No. 1 herd contained seventy-four cows and heifers in the flush; the No. 2 herd of forty-nine cows is composed of those that are giving about 5 or 6 quarts of milk daily; while the twelve cows that were drying off are known as the No. 3 herd. The milking time is arranged so that the flush cows are in the shed, as nearly as possible, at the same hour in the mornings and evenings; the others coming in before and after them at alternate milkings. The keeping of

the herd thus divided according to the amount of milk they are producing has also the advantage of allowing of certain variations in the feeding being practised on this basis. The cows have all a herd number; and from this the age, breeding, or date of purchase, periods of lactation, and yield for any year in milk and butter fat of all the milking stock can be given at a moment's notice by the card system of cataloguing; and they show some very interesting results.

Some spring and autumn seasons are more favorable for milk production than others; and, with dairymen, these are known as good milk seasons, or the reverse. When these months are characterized by mild weather the milk yield will be the best the cows are capable of. The grass grows quicker and lasts longer; and, no matter how well cows are hand fed, if they have access to grazing as well, their milk production will be

Fig. 11.—Dairy Buildings and Stabling, lower down.

largely controlled by the weather. With the Sparrovale herd the dry autumn of 1912 was responsible for a reduction in that year's total gallon yield from that of 1911 of 26 gallons per cow. Again, the splendid autumn of the present year has brought the average of the first six months up to 34 gallons per cow more than that of the same period in 1912; and this with an average of two cows less per week in milk during these months of this year. In 1910 the average for the herd was a little over 400 gallons, but during that year fifty-four Sparrovale-bred heifers came into profit, and their influence is shown in the 1911 returns. In that year the herd was reduced in number by fifty-five head, but the total weekly loss in milk amounted to barely 23 gallons, while the average yearly return was raised from 400.9 gallons to 519.2 gallons per cow. Each of the farm bred heifers, therefore, was about equal to two of the cows that were culled out that year. The dry autumn of the

next year, 1912, was responsible for a reduction in the average yield by 26 gallons per cow; but, as showing how such seasonal variations affect the general milk production, and consequently raise the selling price, it may be mentioned that the nett returns from the milk sold during this drier year of 1912 were £1 1s. 10d. per cow better than those of 1911.

The average yield of 519 gallons for 176 cows during 1911 is a very satisfactory one to have been reached at this stage of the farm's development, and this was the total number of cows on the farm during that year. The average number milked weekly throughout that year was 139; but, as all have to be fed and handled, and all either have or should have taken part in the production of that total of 91,425 gallons, it is the total number of cows on the farm which must be taken into consideration when making the average gallon estimate. Among a large herd of such comparatively recent formation as this is, there is certain to be still much variation in the milking capacity of the individual cows; and the following list, showing the yields that have been obtained from the cows now in the Sparrovale herd, is another example to support the many that have been previously published in this *Journal* in demonstrating the benefits to be derived from herd testing:—

One cow has given 1,102 gallons in a calendar year.
One cow has given 990 gallons in a calendar year.
Five cows gave 850 gallons and over in a calendar year.
Nine cows gave 800 gallons and over in a calendar year.
Thirteen cows gave 750 gallons and over in a calendar year.
Thirteen cows gave 700 gallons and over in a calendar year.
Eighteen cows gave 650 gallons and over in a calendar year.
Nineteen cows gave 600 gallons and over in a calendar year.
Twenty-three cows gave 550 gallons and over in a calendar year.
Twelve cows gave 500 gallons and over in a calendar year.
Eight cows gave 450 gallons and over in a calendar year.
Fifteen cows gave 400 gallons and over in a calendar year.
Four cows gave 350 gallons and over in a calendar year.
One cow gave 300 gallons and over in a calendar year.
Four cows gave 260 gallons and over in a calendar year.

The balance of the herd are heifers which had been in profit from two to twenty-nine weeks, and these had averaged 15½ gallons of milk each up to the end of December, 1912.

The cow at the top of this list—herd No. 380—is a crossbred, dark-red with white back stripe and hind shanks, and is shown in the centre of the group in Fig. 13. She has the sturdy, well-filled frame which characterizes the good doer; and on her appearance alone she would bring a high price in the metropolitan dairy cattle market. Her average yield for the past three years has been 842 gallons; which, at 10d. per gallon, shows a gross return of £35 per year.

Among the heifers, two that came in at the beginning of the year (and whose records are included in the list of cows given) continued in profit the whole twelve months, giving 780 gallons, and 629 gallons for the year. The three longest in milk of those mentioned at the bottom of the list have given respectively 457 gallons in twenty-nine weeks, 467 gallons in twenty-seven weeks, and 493 gallons in twenty-seven weeks. Looking through the returns for the early part of 1913 it was seen that these three heifers completed their first lactation period with an average of 623 gallons, and there appeared every prospect

of more than half the heifers now in the herd clearing 600 gallons on their first milking.

In Fig. 14 the pure bred cows are shown. As mentioned, all of these are Glen Elgin bred Ayrshires; and the records of several of them place them well in the front rank of the Sparrovale milking stock. These cows are now working under the Government herd-testing scheme which is being carried through by this Department in connexion with all herd-book cattle, and their official records bid fair to justify the breeder's claim that they are "dairy" bred as well as pure bred.

The Aryshire bulls that have been used on Sparrovale were purchased from the Glen Elgin, Gowrie Park, and Glen Arthur studs, and the bull "Statesman" (now dead), from the last named herd, has left some heifers which give special promise as milkers.

The pure bred heifers (Fig. 15) that have been raised from the Glen Elgin cows are a nice lot of typical Ayrshires of fine dairy quality, and

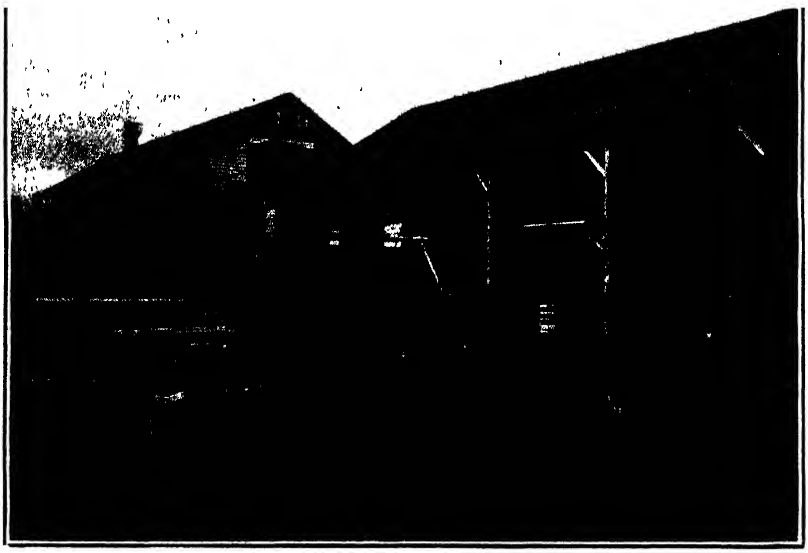


Fig. 12.—Implement Shed and Employes' Quarters.

their future work is looked forward to with interest. Recently another young bull has been purchased from Mr. W. P. Brisbane's Gowrie Park herd, sired by the champion Lessnessock, from Ida of Gowrie, a cow of exceptional dairy quality as regards both yield and test.

The supplying of milk to the metropolis has practically eliminated the pig-raising and fattening, which, in the farm's early stage, was a prominent branch of the work. There is now almost no separated milk to spare for this, and only two pens of breeding pigs are kept; and these are just about the number that can be fed on waste vegetables and kitchen refuse; so that their keep is no actual cost to the farm. One pen is of Berkshires and the other of Middle Yorkshires; the former containing a Stewart (Trafalgar) boar and five sows of R. Madden's strain; and the latter, a Jenkin's (Korrumburra) boar with five sows of G. Madden's breeding. They are a nice shapely lot, of quality well above the average, and their progeny find ready sale in the district.

The regular disposal of the fresh milk also necessitates that calf-raising must be limited to the lowest number possible ; while, on the other hand, experience had demonstrated that the improvement of the herd, or even its maintenance at its present standard, could only be attained through stock bred on the farm. In order, therefore, that calf-rearing should be made as profitable as possible it becomes imperative that only the progeny of the best cows be raised, and it is then that the value of keeping milking records —such as Sparrovale can show—becomes fully recognised, for the trouble of collecting them is being repaid many times over in each season's heifers.

The useful term of a dairy-cow's life varies considerably under different conditions, but eight years would probably be a reasonable average to allow when estimating what provision must be made for replacing them. Many will continue to milk profitably for several years over this, and, with an exceptionally good animal, it would not be wise to dispose of her as long as she would breed ; but, to allow for all contingencies, it is advisable that, at least, one heifer be raised each year to every seven cows in the herd.

There are sixty cows in this Sparrovale herd that have records of over 650 gallons for the year ; or seventy-nine that have cleared the 600-gallon mark. All milk from a cow over 300 gallons can be set down as profit ; for, as a rule, it will take 300 gallons to pay her owner for feeding and milking her. On this basis a cow giving 600 gallons is worth three that give only 400 gallons per year ; and, as a mother of a heifer for future use in the herd, her value is comparatively even much higher than this. What then is the actual value of a well bred heifer from a cow capable of giving over 650 gallons per year ? Any farmer supplying

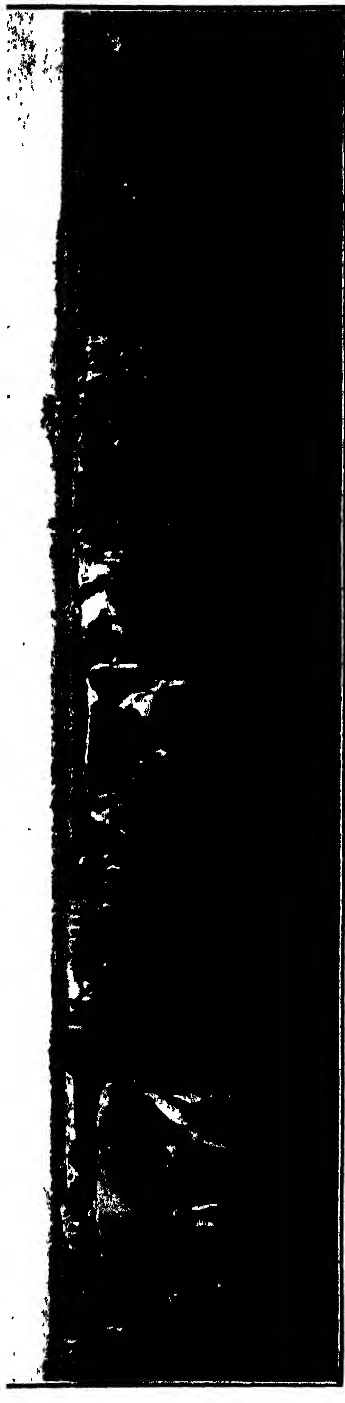


Fig. 13.—No. 1 Herd Grazing down Oat Crop.

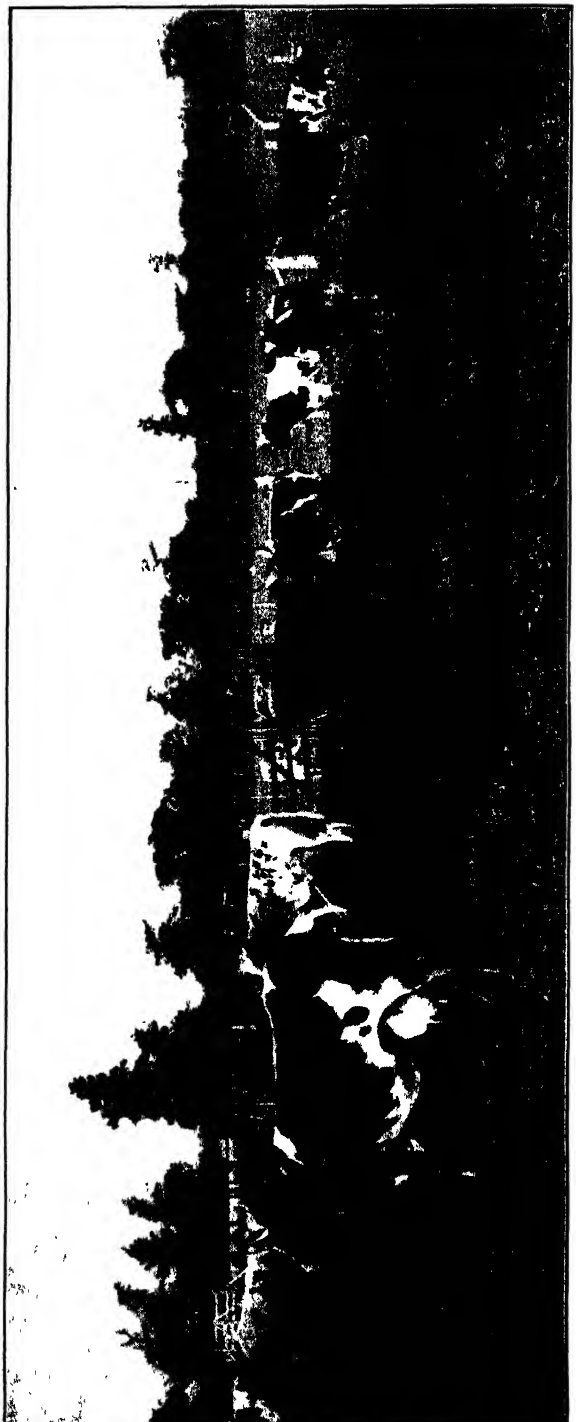


Fig. 14.—Pure-bred Ayrshire Cows.

milk to the Melbourne retail trade would be glad to buy them as springers at £10 a head, or even at a fair advance on this when in profit; while the actual cost of raising and calving them would be covered by at most £7. This would allow of £3 worth of new milk being given to each calf; and every care being taken of it after weaning; and, where the building up of a profitable herd is in progress, calf - raising from 600-gallon cows becomes extremely profitable work even at this high-rearing estimate. It does not require much experience in buying dairy stock to show that heifers of this class are seldom to be met with, and that the only way to get good cows is to breed them; yet there are hundreds of farmers dairying with cattle that do not profit them more than £2 per head each year, and who say they can see nothing in herd-testing to warrant the work. It is the absence of systematic herd-testing and calf-raising that makes dairying show so little profit on many farms.

The whole of Sparrovale impresses the visitor with the thoroughness with which the dairy-farming work is being carried out. The cultivation paddocks, with the crops flourishing there, form the basis of a heavy milk yield by supplying the wants of the stock at all seasons. The herd is in splendid condition throughout, and is being improved in quality yearly, and the pure stock stud is now well enough established to ensure that there will be no need to go off the farm for breeding stock in the future. The market for the milk is a constant one; for its quality, the care taken in handling it, and the reliability of the supply, ensure a satisfactory sale for it at all seasons.

There is no doubt that the Geelong Harbor Trust has worked Sparrovale on sound lines, and by it the larger project of reclamation has been more than justified. Land that, even if cleared, could at best be valued at not more than a 4s. per acre grazing rental, has, by the construction of a levee bank and draining, been proved capable of producing a return so far in advance of this that it is almost beyond com-

Fig. 15.—Sparrovale Ayrshire Heifers.

parison. There are several thousand acres adjacent to Sparrovale which are capable of being similarly improved, every acre of which represents so much increased prosperity possible to the district. More land under cultivation means more food produced, and more money in circulation; and, so far, there appears no obstacle to the possibility of the whole of Reedy Lake, Upper Conewarre, and the South Barwon commons, representing a total of over 3,000 acres, being brought under immediate reclamation, and raised to a standard of productiveness equal to the land on Sparrovale. In 1908 there was held to be, perhaps, more than a semblance of doubt as to the practicability of this scheme, but that stage is passed. Sparrovale has proved the Geelong Harbor Trust to have ventured successfully, or to have judged wisely and acted deliberately, according to whatever aspect the scheme is considered from. In any case, the result has been as forcasted in my previous report, and the financial possibilities of the project have been fully demonstrated.

NOTE ON WHEATS COMPETING FOR PRIZES.

Royal Agricultural Show, Melbourne, 1913.

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

At the September Royal Show an important change was made in the allocation of the prizes for farmers' wheat competitions by the Royal Agricultural Society.

Prizes were offered for four distinct classes of wheats, namely, High Strength Red, High Strength White, Low Strength White, and Macaroni. These four classes comprise practically all varieties in general cultivation in the State. The classification of the sections in accordance with the above scheme served to direct attention to the importance of milling and baking qualities of wheat.

Under existing conditions of marketing wheat in this State, very little encouragement is given to farmers to produce prime samples, since practically the whole harvest is sold on a fair average quality basis—a system of marketing which makes for mediocrity in the quality of the product. Much improvement would naturally follow if the existing mode of marketing were replaced by a system of selling wheat by reference to permanent standards of quality. Even less encouragement is given to the farmer to grow varieties of high milling and baking excellence for many of these varieties do not, under ordinary conditions of culture, yield as well as the commoner varieties. Certainly, there are limited areas in the wheat districts of Australia where the high quality wheats are the good yielders, and in such instances these are profitable varieties to grow. In certain cases, too, millers are willing to pay a premium for wheats like Bobs, Comeback, and Cedar, and this premium has amounted to as much as 3d. to 6d. per bushel.

JUDGING THE WHEATS.

In judging the wheats entered for competition, consideration was given, not only to the general appearance and weight of the samples, but also to the milling and baking qualities of each variety. These latter qualities were determined by milling each variety in the departmental flour mill, and baking the flour in an electric oven. Only in this manner was it possible to separate, with certainty, samples which were very similar in general appearance.

In the four classes there were twenty-four entries. Competition was keenest in the Low Strength White Class, in which sixteen entries were received. The most popular varieties submitted in this section were Yandilla King, Dart's Imperial, and Purple Straw.

In awarding the prizes, points were given for the following:—Weight per bushel 15, general appearance and condition of sample 15, ease of milling and flour yield 10, colour of flour 10, strength of flour 20, percentage of gluten 12, quality and texture of the loaf 18 points—total, 100 points.

The weight per bushel was obtained by filling a standard bushel measure with the grain under standard conditions. The colour of the flour was determined by the well-known Pekar's Test. The strength of the flour was estimated by determining the water absorption capacity of

the flour, and the percentage of gluten by the well-known washing process, confirmed by a Kjeldahl estimation for nitrogen. The quality of the bread was gauged by taking into consideration the weight, volume and pile of the loaf. The working methods for securing this data have already been discussed in this *Journal.**

LOW STRENGTH WHITE CLASS.

In the Low Strength White Class the competition was very keen. The first prize was awarded to Entry 4642—a fine, bright sample of Dart's Imperial Wheat, grown by C. F. Schultz and Sons, Dimboola, on fallowed black soil. The seed used was 1 bushel per acre, superphosphate 45 lbs. per acre, and the yield 30 bushels per acre. The weight per measured bushel—68.6 lbs., was exceedingly high, the general appearance and condition of the sample very good, and the strength, gluten content of flour, and the weight and volume of bread very satisfactory for a wheat of its class. The total points awarded were 86½.

The second prize was awarded to Entry No. 4635, a bright sample of Dart's Imperial, grown by P. Moller, Dimboola, on chocolate soil. The seed (1 bushel per acre) was sown with 50 lbs. of superphosphate, and the yield was 30 bushels per acre. The weight per bushel was 67.6 lbs., and the colour of the flour excellent. The points awarded were 84½.

The third prize was awarded to Entry 4641—King's Early, grown by Johann B. Schultz at Arkona. The points awarded were 83½.

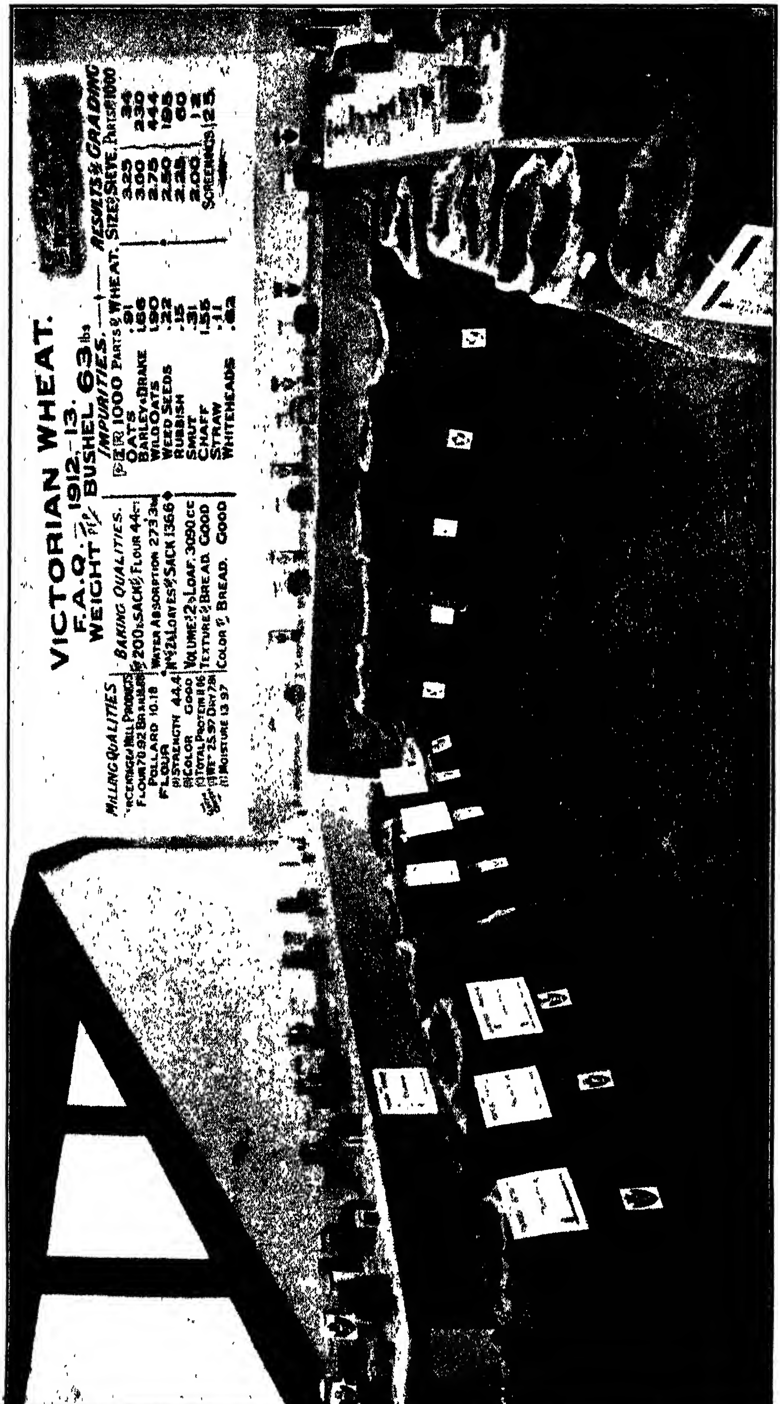
Table I. gives a synopsis of points awarded to each of the wheats submitted for competition. In the brackets under the headings, "Bushel Weight," "Strength," and "Gluten Content," the actual figures obtained have been included.

TABLE I.

LOW STRENGTH WHITE WHEATS.

Entry Number.	Bushel Weight.	General Appearance.	Ease of Milling and Flour Yield.	Colour of Flour.	Strength of Flour.	Gluten per Cent	Weight, Volume, and Texture of Loaf.	Total
Maximum Points ..	15	15	10	10	20	12	18	100
4642 ..	(68.6) 15	13	7	7	(47.2) 17	(8.38) 10½	17	86½
4635 ..	(67.6) 13	13	7½	10	(44.0) 14	(8.52) 10½	16½	84½
4641 ..	(68.7) 15	12	6½	9	(45.0) 15	(7.84) 10	16	83½
4633 ..	(68.1) 14	10	9	9	(44.0) 14	(8.58) 10½	16½	83
4634 ..	(66.6) 11	12	10	9½	(45.4) 15½	(7.35) 9½	14½	82
4632 ..	(66.6) 11	10	8½	9	(45.4) 15½	(9.04) 11	15	80
4627 ..	(67.4) 13	11	6	9	(42.8) 13	(10.09) 12	16	80
4629 ..	(66.2) 10½	11	7	9	(45.0) 15	(9.51) 11½	15½	79½
4640 ..	(66.6) 11	11½	6½	10	(44.80) 15	(7.70) 9½	15½	79
4630 ..	(66.1) 10½	10	7	9	(45.40) 15½	(7.82) 10	16½	78½
4628 ..	(66.7) 11	10	7½	9	(44.20) 14	(9.36) 11½	15½	78½
4631 ..	(66.4) 11	9½	8	5	(44.20) 14	(8.26) 10½	16	74
4636 ..	(66.0) 10½	6	6	9	(42.0) 12	(6.92) 9	17	69½
4639 ..	(65.5) 9½	8½	9½	5	(44.20) 14	(5.91) 8	13	67½
4638 ..	(64.4) 7½	9½	6½	8½	(41.40) 11½	(6.54) 8½	15	67
4637 ..	(64.6) 7½	8	7	5	(41.0) 11	(5.91) 8	15	61½

* *Journal of Agriculture of Victoria*, October. 1913, pp. 625–629.



FARMERS' WHEAT COMPETITIONS, ROYAL AGRICULTURAL SHOW, MELBOURNE.

It may be said by way of explanation of this table, that the commercial value of a flour depends on its colour, strength, and gluten content, and that the value of a wheat for milling is determined by its bushel weight, its general condition, and also by the amount of high-class flour it will produce. Consequently, in making comparisons of the value of wheats, these factors have been taken into account.

The colour of the flour is very important to the miller, and his constant aim is to produce a flour which will yield, on baking, a loaf of snow-white colour. The consuming public have got into the habit of judging the quality of bread by its colour. That is the reason why dark-coloured bread, such as is made from certain macaroni wheats, is objectionable, although, of course it does not follow that the dark bread is less nutritious than white bread. One of the reasons why Australian wheat is so highly prized on the English market is that it yields, on milling, a flour of excellent colour, and is, therefore, of the greatest value in blending with the darker, but stronger and more glutenous, foreign wheats.

By the "Strength of the flour" is meant the amount of well-piled bread of suitable crumb and texture obtained per sack of flour. There are difficulties in measuring this, and, in practice, the strength is usually determined by the number of quarts of water absorbed by a 200-lb. sack of flour, in order to make a dough of a consistency fit for baking. Thus, a flour with a strength of 50 means that a 200-lb. sack will absorb 50 quarts of water in the process of doughing.

The gluten is, of course, one of the most important constituents of the flour. The nutritive value of the bread largely depends on the amount of gluten present. Moreover, it has important influence on the baking quality of the bread. There must be a sufficient quantity of gluten present in the flour to retain the gas produced during fermentation, and the quality of the gluten must be such as to confer elasticity on the dough. The gluten content of the exhibits varied very widely, and the amount present was generally low. The flour of each sample was made into dough and baked, and the volume, weight, texture, and quality of the loaves were obtained.

HIGH STRENGTH RED.

TABLE II.

HIGH STRENGTH RED WHEAT.

Entry Number.	Bushel Weight.	General Appearance.	Ease of Milling and Flour Yield.	Colour of Flour.	Strength of Flour.	Gluten per Cent.	Weight, Volume, and Texture of Loaf.	Total
Maximum Points ..	15	15	10	10	20	12	18	100
4622 ..	(68.25) 14	15	8	7	(57.60) 20	(9.71) 11½	17	92½
4623 ..	(66.4) 10	10	9	5	(43.0) 8	(9.78) 11½	14	67½

In the High Strength Red Class there were only two entries, and one of these should properly be included in another section—Low Strength Red. The prize was awarded to Entry No. 4622, with a magnificent

sample of hard red wheat—Cedar—of exceptional strength and milling quality. The sample was extremely uniform, of high bushel weight (69.5 lbs.), very attractive in appearance, and gave a loaf of good pile and texture. The winning wheat was grown by Mr. W. H. Scholz, of Gilgandra, New South Wales, on red loamy soil. No manure was sown with the seed, which was sown at the rate of 30 lbs. per acre. The yield was 25 bushels per acre.

HIGH STRENGTH WHITE.

Three entries were received for this section, and though the varieties appeared to be similar, considerable differences were observable in the behaviour of the samples in the mill and in the oven.

The First Prize was awarded to Entry No. 4625, with a total of 90 points. This sample weighed extremely well (68.6 lbs. per bushel), and gave a good yield of strong flour of excellent baking quality. The variety was Comeback, grown by Mr. J. B. Schultz, at Arkona, on red, loamy soil, and gave the fine yield of 35 bushels per acre, on soil manured with 50 lbs. of superphosphate per acre.

The Second Prize was awarded to a sample of Comeback grown by C. F. Schultz and Sons, of Dimboola. This wheat also gave a good yield of strong flour. It was raised on fallowed black soil, and gave a yield of 37 bushels per acre, with 45 lbs. of superphosphate.

TABLE III.

HIGH STRENGTH WHITE WHEATS.

Entry Number	Bushel Weight	General Appearance	Ease of Milling and Flour Yield.	Colour of Flour	Strength of Flour.	Gluten per Cent	Weight, Volume, and Texture of Loaf.	Total
Maximum Points	15	15	10	10	20	12	18	100
4625 ..	(69.1) 15	13	10	9	(53.0) 16	(7.86) 10	17	90
4626 ..	(68.0) 13	13	10	8½	(54.0) 17	(8.76) 10½	14	86
4624 ..	(66.6) 11½	10	8	5	(53.0) 16	(6.06) 8	15	73½

MACARONI WHEAT.

Three entries were received in this class, but the standard of quality was not high. Entry No. 4620 lost points for containing an admixture of bread wheat. The amount of bread wheat present in this sample accounts for its comparatively high baking qualities. The prize was awarded to Entry No. 4619—a sample of "Velvet Don," grown by Mr. W. H. Scholz, Gilgandra, New South Wales. Its chief characteristics were comparatively high bushel weight, fine appearance, high flour yield, and flour strength. This wheat was grown on red, loamy soil, and yielded at the rate of 24 bushels per acre without any manure. Seed used per acre, 30 lbs.

The Second Prize was awarded to Entry No. 4621, "Indian Runner," grown by W. Clark, Angle Vale, South Australia. The wheat and flour of this variety gave a high protein content.

TABLE IV.

MACARONI WHEATS.

Entry Number.	Bushel Weight.	General Appearance.	Ease of Milling and Flour Yield.	Colour of Flour.	Strength of Flour.	Gluten per Cent.	Weight, Volume, and Texture of Loaf	Total
Maximum Points .	15	15	10	10	20	12	18	100
4619 ..	(66.6) 13½	13	10	5	(47.10) 17	(10.06) 7	13	78½
4621 ..	(66.1) 13	11	7½	5	(47.20) 17	(12.02) 10	14½	78
4620 ..	(66.25) 13¼	10	7½	6	(46.0) 15	(10.47) 7	16	74¾

CHAMPION PRIZE OF AUSTRALIA.

The Champion Prize of Australia was awarded to Mr. W. H. Scholz's sample of Cedar, which won in the High Strength Red Class. This was easily the best wheat exhibited in all sections. Its high bushel weight, bright, extremely uniform, attractive appearance, and its exceptional milling quality, combine to make it stand out prominently from all other varieties shown.

TABLE V.

CHAMPION PRIZE OF AUSTRALIA

Entry Number.	Bushel Weight	General Appearance	Ease of Milling and Flour Yield	Colour of Flour.	Strength of Flour	Gluten per Cent.	Weight, Volume, and Texture of Loaf.	Total
Maximum Points	15	15	10	10	20	12	18	100
4622 ..	(68.25) 14	15	8	7	(57.60) 20	(9.71) 11½	17	92½

An interesting contrast is afforded by comparing the results obtained from the Champion sample with those obtained by averaging the sixteen low strength white wheats entered for competition, and with the Victorian F.A.Q. sample for 1912-13. Table VI. shows this comparison:—

TABLE VI.

Variety	Bushel Weight.	Yield of Flour.	Strength of Flour	Protein Content of Wheat.	Gluten Content of Flour	Percentage of Weeds, Smut, Rubbish, &c.
	lbs.	%	Quarts per 200lb. sack.	%	%	%
Cedar	68.8	73.03	57.6	11.43	9.71	Nil
Average of 16 samples of low strength wheats	66.7	71.08	44.1	10.39	7.98	Undetermined
Victorian F.A.Q. sample 1912–13	63.0	70.92	44·8	10.68	7.81	.74

It will be observed that, in yield of flour, strength of flour, protein content of wheat, and gluten content of flour, the average of the sixteen samples of low strength white agree closely with that of the F.A.Q. sample. The superiority of Cedar stands our prominently.

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

PART X.—PACKING—*continued.*

(*Continued from page* 563.)

By E. Meeking, Senior Fruit Inspector.

A PLEA FOR THE INTRODUCTION OF THE DIAGONAL NUMERICAL SYSTEM OF PACKING APPLES—*continued.*

When the case has been properly packed, the top should show a bulge of about 1½ inches. The top is fastened by nailing a

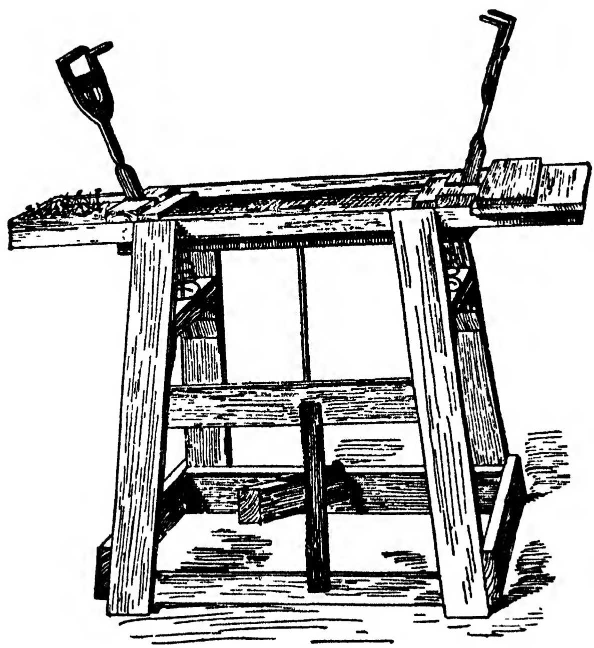


PLATE IV. (*a*).

Box press used in America.

cleat at one end and then pressing the top to the other end of the case where it is fastened by another cleat. The pressure thus brought upon the fruit should reduce the bulge on top by one-half, and, of course, cause a bulge of corresponding dimensions on the bottom of the case. The bulge in a properly packed case should thus be about ¾ of an inch both top and bottom. To obtain the bulge the case must, of course, be packed on a stand or table constructed with a space sufficiently large to permit the bulging

of the bottom when the pressure used in fastening the top is applied. For fastening the case, special box presses are used in America. One type of these is illustrated in Plate IV., and is taken from "Bulletin No. 19," Dairy and Cold Storage Commissioner Series, Ottawa, Canada. This press may be constructed of hardwood as follows:—Legs, four pieces, 2 inches by 4 inches, 2½ feet long. Bed pieces, 4 feet long by 12 inches wide. The cross cleats are arranged to allow the case to project ¾ of an inch at each end. The clamps, which can be made by a blacksmith, should pass through the lower plank, to which they are attached by an iron pin running through the clamp and plank. The pressure is brought upon the top of the case by the foot lever, and the springs serve to release the case after nailing has been completed.

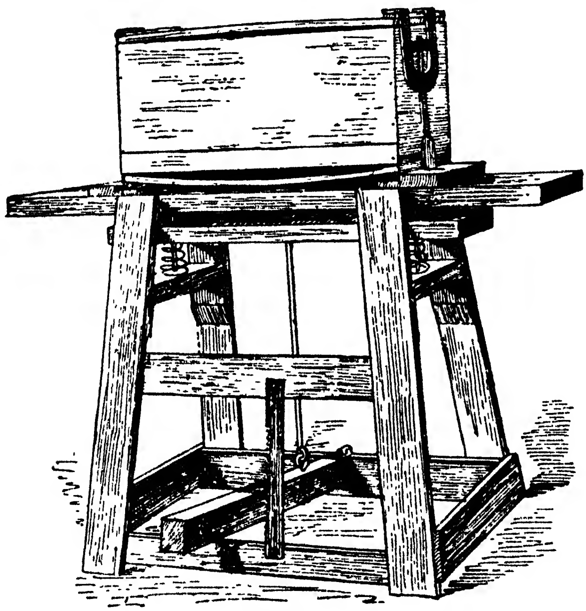


PLATE IV. (*b*).

Box press showing box in position

The cleats for fastening the tops of the case should be soaked in water before being nailed, as this allows the nails to be driven easily and prevents splitting of the cleats. The type of nail recommended is the 2½-inch "Special Wire Nail," which can be obtained wholesale for 22s. 6d. per cwt. The notches in this nail prevent the tops and bottoms from bursting away during transportation. This nail costs 1s. 6d. per cwt. more than the ordinary nail, but the advantage which its use gives in forming a secure package, justifies the slight extra expense. Four of these nails are sufficient to secure each cleat.

The Importance of the Bulge in Properly Packed Cases.

In the United States of America and Canada it is considered of the utmost importance that the bulge should approximate the dimensions

mentioned above, as this indicates that the fruits have been correctly graded, and have been packed with sufficient tightness to minimize jolting during transportation. For example, if the bulge is below the correct size it indicates that the fruits selected have been of a smaller grade than should have been chosen in conformity with the pack, or that the case has been incorrectly packed in other respects. If the bulge is excessive, it indicates either that the fruits have been selected in a grade which is too large for the pack aimed at, or that they have been incorrectly placed either on their sides or ends, as the case may be. The chief advantage which is claimed for the bulge is that it acts as a cushion against jolts, and also that, on account of the thinness of the wood used for the tops and bottoms, the shrinkage of the wood takes place with the shrinkage of the fruits. The pressure is thus kept on the fruits enabling the tightness of the pack to be maintained much better than would be done if rigid wood were used for the tops and bottoms.

In packing to obtain the correct bulge, the expert packer packs the apples in such manner that the bulge results as a natural consequence,

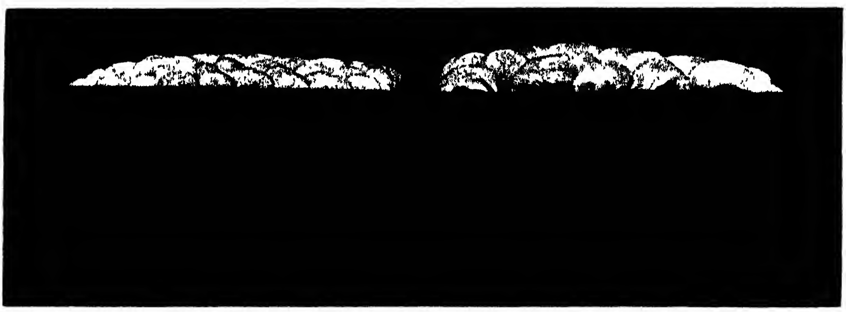


Fig. (*a*). PLATE V. Fig. (*b*).

Packed cases showing (*a*) correct bulge and (*b*) excessive bulge.

as the sides and ends of the case are too rigid to permit any "give." It therefore follows that when the apples are packed with the necessary tightness, the lateral pressure which is brought to bear is transferred to the top and bottom of the case. The spaces at the ends of the case also being larger than the spaces in the middle, cause the apples in the middle rows to bulge in a vertical direction.

The illustrations in Plate V. show cases with (*a*) the correct bulge, and (*b*) an excessive bulge in packed Canadian cases. In stowing the cases for transportation purposes, they are, of course, stacked on their sides or ends. The tops and bottoms have therefore to carry no weight. For convenience in packing, the Canadian case, being wider and shallower than the Australian case, affords the packer much greater accessibility to his work. In the Canadian case the pack is tightened by gradual pressure, whereunder bruising of the fruit is avoided, whereas in the Australian case the case is "dumped" to secure the necessary tightness, thus bruising, in most instances, the top and bottom tiers.

The following schedule shows the different packs used for packing fruit in the Canadian case under the numerical system.

SCHEDULE OF DIFFERENT "PACKS" USED FOR PACKING FRUIT IN THE UNITED STATES UNDER THE NUMERICAL SYSTEM.

Approx. Diameter of Apple.	Pack		Apples to Case.	
	2 × 2 "*Packs*"	4 *tiers to case*		
3¾ inches	3 × 4	= 2 rows of 3 + 2 rows of 4 = 6 + 8 = 14 × 4 =	56	3½ tier
3⅝ ,,	4 × 4	= 2 ,, 4 + 2 ,, 4 = 8 + 8 = 16 × 4 =	64	3½ tier
3½ ,,	4 × 5	= 2 ,, 4 + 2 ,, 5 = 8 + 10 = 18 × 4 =	72	3½ tier
3⅜ ,,	5 × 5	= 2 ,, 5 + 2 ,, 5 = 10 + 10 = 20 × 4 =	80	3½ tier
3⅜ ,,	5 × 6	= 2 ,, 5 + 2 ,, 6 = 10 + 12 = 22 × 4 =	88	3½ tier
3¼ ,,	6 × 6	= 2 ,, 6 + 2 ,, 6 = 12 + 12 = 24 × 4 =	96	4 tier
3⅛ ,,	6 × 7	= 2 ,, 6 + 2 ,, 7 = 12 + 14 = 26 × 4 =	104	4 tier
3⅛ ,,	7 × 7	= 2 ,, 7 + 2 ,, 7 = 14 + 14 = 28 × 4 =	112	4 tier
3 ,,	7 × 8	= 2 ,, 7 + 2 ,, 8 = 14 + 16 = 30 × 4 =	120	
	3 × 2 "*Packs*"	5 *tiers to case*		
3 inches	4 × 5	= 2 rows of 4 + 3 rows of 5 = 8 + 15 = 23 × 5 =	113	4 tier (*)
2⅞ ,,	5 × 5	= 2 ,, 5 + 3 ,, 5 = 10 + 15 = 25 × 5 =	125	4 tier
2⅞ ,,	5 × 6	= 2 ,, 5 + 3 ,, 6 = 10 + 18 = 28 × 5 =	138	4½ tier (*)
2¾ ,,	6 × 6	= 2 ,, 6 + 3 ,, 6 = 12 + 18 = 30 × 5 =	150	4½ tier
2⅝ ,,	6 × 7	= 2 ,, 6 + 3 ,, 7 = 12 + 21 = 33 × 5 =	163	4½ tier (*)
2⅝ ,,	7 × 7	= 2 ,, 7 + 3 ,, 7 = 14 + 21 = 35 × 5 =	175	5 tier
2½ ,,	7 × 8	= 2 ,, 7 + 3 ,, 8 = 14 + 24 = 38 × 5 =	188	5 tier (*)
2⅜ ,,	8 × 8	= 2 ,, 8 + 3 ,, 8 = 16 + 24 = 40 × 5 =	200	5 tier
2¼ ,,	8 × 9	= 2 ,, 8 + 3 ,, 9 = 16 + 27 = 43 × 5 =	213	5 tier (*)
2¼ ,,	9 × 9	= 2 ,, 9 + 3 ,, 9 = 18 + 27 = 45 × 5 =	225	5 tier

NOTE.—The packs marked thus (*) do not work out with mathematical accuracy. The reason of this is that, in order to obtain the proper pack for these packs, the same number of apples cannot be placed in each tier. Each alternate tier, therefore, contains one apple less than the adjacent tier. For instance, in the 7 × 8, 3 × 2 pack, the first tier would contain three rows of 8, plus 2 rows of 7 = 24, plus 14—a total of 38 apples to the tier. The second tier would contain 3 rows of 7, plus 2 rows of 8 = 21, plus 16—a total of 37 apples to the tier, and so on throughout the case. The first, third, and fifth tiers would, therefore, contain 38 apples each, and the second and fourth tiers would contain 37 apples each. As the two latter mentioned tiers would contain two apples less than the first, third, and fifth tiers, we would get a total of 188 apples to the case, instead of 190, which should be the number if all the tiers contained an equal quantity of apples. Plate 3 will serve to illustrate how the apples are arranged in this pack, and will also serve as an index to the manner in which all packs containing alternating numbered tiers are adjusted.

(To be continued.)

VERY large mangels may contain only 6 per cent. of dry matter, while in quite small roots the dry matter may amount to 15 per cent. Potatoes do not deteriorate in quality as they increase in size.

A GOOD dairy fodder contains in small quantity certain stimulating substances valuable for their physiological effects rather than as supplying nourishment or energy. Non-protein nitrogen compounds, salt, and certain aromatics come under this head. Their action is obscure.

PERSEVERANCE is the bridge by which difficulty is overcome.

IN pasturing lucerne it must not be overstocked, as the animals will injure the crowns, and the plants will die.

STATISTICS.

Rainfall in Victoria.—Third Quarter, 1913.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with the corresponding monthly and quarterly averages for each Basin, deduced from all available records to date.

Basin or District.	July.		August.		September.		Quarter.	
	Total	Average.	Total.	Average.	Total	Average.	Total.	Average.
	points.	points.	points.	points.	points.	points	points	points.
Glenelg and Wannon Rivers	196	330	377	299	370	308	943	937
Fitzroy, Eumerella, and Merri Rivers	259	362	397	320	378	323	1,034	1,005
Hopkins River and Mount Emu Creek	163	245	295	254	371	280	829	779
Mount Elephant and Lake Corangamite	151	233	280	240	289	276	720	749
Cape Otway Forest ...	305	400	566	399	483	405	1,354	1,204
Moorabool and Barwon Rivers	191	228	298	240	262	261	751	729
Werribee and Saltwater Rivers	122	195	190	206	158	253	470	654
Yarra River and Dandenong Creek	123	315	330	297	225	338	678	950
Koo-wee-rup Swamp ...	199	309	359	316	233	354	791	979
South Gippsland	250	365	329	375	300	417	879	1,157
Latrobe and Thomson Rivers	192	311	396	334	238	389	826	1,034
Macallister and Avon Rivers	50	156	155	210	64	208	269	574
Mitchell River	60	226	176	197	63	266	299	689
Tambo and Nicholson Rivers	64	206	155	175	118	237	337	618
Snowy River	123	301	282	239	267	310	672	850
Murray River	74	215	142	188	201	188	417	591
Mitta Mitta and Kiewa Rivers	161	444	361	318	322	327	844	1,089
Ovens River	169	464	352	337	352	343	873	1,144
Goulburn River	107	297	225	252	190	252	522	801
Campaspe River	137	273	201	239	228	269	566	781
Loddon River	110	192	165	191	224	192	499	575
Avon and Richardson Rivers	79	164	140	171	205	179	424	514
Avoca River	95	190	147	178	241	179	483	547
Eastern Wimmera	92	246	199	239	280	249	571	734
Western Wimmera	137	244	209	211	393	226	739	681
Mallee District	32	140	50	142	166	146	248	428
The whole State	122	252	226	233	245	250	593	735

N.B.—100 points = 1 inch.

H. A. HUNT,

Commonwealth Meteorologist.

EXPORTS FROM THE STATE FOR THREE MONTHS (1st JULY–30th SEPTEMBER, 1912 and 1913.

(NOT INCLUDING WOOL, HIDES, AND OTHER PRODUCTS, THE INSPECTION OF WHICH IS NOT UNDER GOVERNMENT SUPERVISION.)

Description of Produce		Quantities. 1912	Quantities. 1913.	Values 1912	Values 1913.
				£	£
DAIRY PRODUCE—					
Butter	lbs.	1,325,291	2,069,730	66,264	103,486
Milk and Cream	cases	559	1,484	1,397	3,710
Milk (dried) . ..	,,	650	7,200	812	9,000
Cheese	lbs.	12,542	28,460	287	652
Ham and Bacon .. .	,,	13,200	27,212	385	793
				69,145	117,641
POULTRY . .	head	10,875	18,750	2,175	3,750
MEAT—	..				
Mutton and Lamb .	crcs.	11,077	331,847	5,538	165,023
Beef	qrs.	2,699	4,580	6,747	11,450
Veal	crcs.	80	1,208	120	1,812
Pork	,,	..	..	..	..
				12,405	179,185
RABBITS AND HARES	pairs	676,176	1,025,808	28,174	42,742
TALLOW	cwt.	31,997	58,183	45,759	84,250
GRAIN AND FLOUR—					
Wheat	centals	734,710	644,769	270,643	203,680
Oats	..	6,034	9,024	2,283	2,846
Flour	,,	407,564	403,390	184,345	167,985
Maize	,,	246	41	129	17
				457,400	374,528
FODDER—					
Chaff	bags	27,046	30,845	6,934	5,632
,, (compressed)	bales	17,337	32,091	4,821	5,789
				11,755	11,421
POTATOES—					
Oversea	bags	277	899	194	153
,, ...	cases	..	186	..	28
Interstate	bags	125,305	255,519	86,817	48,957
				87,011	49,138
ONIONS—					
Oversea	bags	478	5,447	646	2,566
,, ...	cases	..	63	..	21
Interstate	bags	13,303	26,940	14,858	12,785
				15,504	15,372

EXPORTS FROM THE STATE FOR THREE MONTHS (1st JULY–30th SEPTEMBER), 1912 and 1913—*continued.*

Description of Produce		Quantities.		Values.	
		1912	1913.	1912.	1913.
		£	£	£	£
Fruit—					
Fresh	cases	4,660	9,991	2,329	4,994
Dried	,,	7,325	3,958	14,650	6,996
Canned	,,	2,903	2,103	5,806	4,206
				22,785	16,196
Sundries—					
Honey	lbs.	7,906	10,861	274	374
Jams	,,	244,405	310,131	8,832	4634
Seeds	pkgs.	82	310	246	930
Plants, Shrubs, &c.	,,	412	381	412	381
				9,764	6,219
Grand Totals—3 Months, 1912		..	..	761,877	..
,, ,, ,, 1913		..	..	900,542	..

R. CROWE,
Exports Superintendent.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

Monthly Report ending 14th October.

The sixth monthly report of the above competition is as follows:—

The weather, during the past month, has been mild, but two or three of the days were rather warm, a difference in the outside temperature of the pens of 21 degrees for two days in succession being shown.

The output of eggs for the month was 8,838, as compared with 8,612 eggs last month.

The leading pen J. H. Gill (Pen 23) has now a grand total of 838 eggs, whilst C. J. Beatty (Pen 11) and E. A. Lawson (Pen 65) 760 eggs each are equal for second place; the third, Thirkell and Smith (Pen 48) has 758 eggs to its credit.

Food.—The morning mash was similar to that of the former month with the exception of one part oaten pollard and additional green stuff. On several occasions raw onions were cut up fine and mashed into the pollard. Grain consisted of wheat, except during cold winds and wet weather, when equal parts of wheat and maize was fed. Green food, at midday, consisted of grass, thistle, and green lucerne chaff, which were also fed in the morning mash.

Broodiness is becoming more pronounced as the warm weather advances; several of the birds from the pens of the heavy breeds had to be removed for this reason, caused no doubt by the sudden change into warm weather.

The general health of the birds is excellent, all being bright and vigorous. Egg production is well maintained.

The rainfall, spread over eight days, registered 104 points.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition: April 15 to Sep 14	Sep. 15 to Oct. 14.	Total to date—6 months.	Position in Competition.
23	White Leghorns ..	J. H. Gill	685	153	838	1
11	,, .	C. J. Beatty ..	609	151	760	2
65	,, ..	E. A. Lawson .	613	147	760	2
48	,,	Thirkell and Smith .	613	145	758	4
61	,, .	Jno. Campbell .	614	140	754	5
6	,, ..	J. S. Spotswood .	607	146	753	6
8	,,	E. H. Bridge	597	149	746	7
10	,,	T. A. Pettigrove .	578	150	728	8
31	,,	W. G. Swift .	572	143	715	9
35	,, ..	Moritz Bros .	551	150	701	10
50	,, .	A. H. Mould .	551	142	693	11
34	,, .	J. E. Bradley	551	139	690	12
7	,, .	H. McKenzie ..	532	157	689	13
21	,,	A. Ross ..	548	140	688	14
49	,, .	M. H. Noye	536	142	678	15
37	,, ..	C. H. Busst ..	532	135	667	16
46	Black Orpingtons	T. W. Coto .	552	111	663	17
66	White Leghorns	W. Featherstone	520	138	658	18
32	,, ..	H. Hanbury ..	510	143	653	19
40	,,	Geo. Edwards .	506	145	651	20
20	,, .	C. B. Bertelsmeier .	503	146	649	21
5	,,	G. W. Robins ..	493	151	644	22
26	,,	B. Rolls ..	499	136	635	23
43	,, . .	Morgan and Watson	495	132	627	24
63	,, .	A. Sellars ..	486	141	627	24
2	,, ..	R. W. Pope .	485	140	625	26
41	,, .	Walter Percy ..	485	136	621	27
24	,,	Redfern Poultry Farm	470	145	615	28
58	,,	Stranks Bros. ..	478	137	615	28
47	,, .	W. McLister .	487	126	613	30
13	Black Orpingtons ..	T. S. Dallimore ..	479	123	602	31
67	White Leghorns ..	C. Hepburn .	459	140	599	32
38	,, .	M. A. Monk	469	129	598	33
45	,, ..	D. Goudie . .	457	137	594	34
59	,,	Cowan Bros	450	143	593	35
14	,,	S. Hannaford ..	449	138	587	36
25	Black Orpingtons .	King and Watson ..	455	125	580	37
18	White Leghorns ..	B. Rowlinson ..	433	135	568	38
3	,, .	S. Buscumb ..	433	134	567	39
42	,, ..	A. Stringer ..	415	149	564	40
33	,,	South Yan Yean Poultry Farm ..	414	148	562	41
52	,,	W. G. Osborne ..	428	132	560	42
27	,, ..	A. Sinclair	415	135	550	43
62	,, .	G. A. Gent ..	406	138	544	44
12	,,	A. H. Padman ..	393	148	541	45
22	,, .	B. Mitchell ..	407	130	537	46
55	,, .	P. H. Killeen ..	426	108	534	47
56	,, ..	Schaefer Bros. ..	386	145	531	48
53	Black Orpingtons ..	A. Greenhalgh ..	393	136	529	49
44	White Leghorns ..	W. A. Rennie ..	384	136	520	50
57	,, ..	Gleadell Bros. ..	369	146	515	51
54	,, .	J. McAllan	377	130	507	52
51	Black Spanish .	W. H. Steer .	368	136	504	53
36	White Leghorns ..	A. J. Jones ..	362	138	500	54
28	,, ..	E. Waldon	350	131	481	55
29	,, ..	S. Brundrett ..	330	144	474	56
19	,, ..	W. H. Dunlop ..	351	119	470	57
17	R.C. Brown Leghorns	S. P. Giles	357	110	467	58
30	Black Orpingtons ..	Jas Ogden ..	315	143	458	59
64	Golden Wyandottes	C. L. Sharman ..	317	139	456	60
60	Black Spanish ..	Watson and Rushworth	283	143	426	61
15	White Leghorns ..	J. Shaw	284	126	410	62
4	,, ..	J. A. Brigden ..	261	130	391	63
9	White Leghorns ..	Sylvania Stud Farm	227	138	365	64
		Totals	29,360	8,838	38,198	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Pests.

As a preventive against codlin moth, the trees should be kept well sprayed with arsenate of lead. It has been definitely ascertained that this is the best remedy, and all other mixtures should be discarded in its favour. Its permanent qualities, combined with an effective killing strength, render this mixture invaluable; at the same time, it is easily mixed, and so very few brands leave any sediment, that the work of spraying is now reduced to a minimum.

If the spraying is careful and thorough, no bandaging need be carried out. The time spent in bandaging would be far better employed in an extra spraying. The first spraying should have been given at the time of the falling of the petals; the second spraying, owing to the rapid expansion of the fruit, should be given a fortnight later. After that, the grower must use his own judgment as to the necessity for subsequent spraying. If the moths be at all prevalent, other sprayings will be quickly necessary.

For the cherry slug, arsenate of lead may be used, except where the cherries are approaching ripeness; hellebore, lime, or tobacco water should then be used.

The work of cultivation, ploughing, and harrowing should be completed immediately. It is always advisable to have the land well tilled before the dry weather sets in.

All crops for green manure should now be under cover; and, if the orchard soil is at all heavy or sticky, the grower should make up his mind to grow a cover crop next season, in order that this condition may be reduced.

The orchard should be kept free from weeds, not only for the conservation of moisture, but to do away with all hiding places of the Rutherglen fly, cut worm moths, &c.

General Work.

Grafted and newly planted trees should be frequently examined, and given an occasional watering and overhead spraying to encourage their growth, and to prevent loss of moisture from the foliage. It is also advisable to mulch young trees with a light grass or straw mulching, not too rich in animal manure.

The disbudding of unnecessary shoots, and the pinching back or stopping of growths, to prevent them being unduly prolonged, may now be carried out. This work is particularly important on young trees. Graft ties should be examined, and the ties cut wherever any growth is being made. Where the grafts are likely to make any long growth, they should be well staked and tied.

Citrus trees may be planted out, watering and mulching them after planting.

Vegetable Garden.

Celery may be now sown for winter crops. French beans should be largely sown. Cucumber, melon, and pumpkin, and all seeds of this family may now be sown in the open. Where these plants are already growing, the longest and strongest runners should be pinched back to throw the strength into the flowering and lateral growths. Watch these plants for mildew, and use sulphur freely wherever present, especially on young plants.

Peas, lettuce, radish, and turnips, cabbage, and sweet corn seeds may be sown this month. Seedlings from former sowings may be planted out, and it may be well to dip the whole plant in water before planting. This greatly assists the young plant while taking hold of the soil in its new location.

Frequent waterings and frequent cultivation will now be necessary, and all weeds must be hoed or hand weeded out; mulching with stable manure will greatly assist the plants.

A few beds should now be deeply worked, adding a liberal dressing of stable manure. These plots will then be ready for the celery, cabbage, and other seeds planted during the month.

Tomato plants will now require constant attention, watering, staking, and thinning, and pinching back of the laterals.

Flower Garden.

Hoeing, surface cultivation, watering, and mulching are the principal necessities for the flower garden this month. One hoeing is worth half a dozen waterings. Keeping the soil surface loose and providing an earth mulch for the plants is far more beneficial, and far less weakening than excessive waterings, to which the garden plants are so frequently subjected in summer. It is safe to say that a greater number of plants are lost in summer through excessive watering than through the absence of water. Further, the light sprinklings which are so frequently given in hot weather rarely reach the roots of the plant, and only serve to cake and harden the soil, resulting in a further loss of moisture by capillary attraction.

If not already planted out, all bedding and foliage plants should now be in their places in the garden—included amongst these are begonias, salvias, alternantheras, iresines, &c.—while annuals for autumn flowering should now be sown.

All bulbs, corms, and tubers that have ripened their foliage may be removed from the beds, after the foliage has died, and stored in a cool place till next season. Precautions should be taken against damp, which will cause the bulbs to decay.

Herbaceous plants, such as perennial phlox, delphiniums, campanula, as well as gladioli, will all be benefited considerably by liberal waterings of liquid manure, or by mulching with well-rotted manure. Whenever necessary, these should all be staked.

Dahlias and chrysanthemums for early flowers should now be planted.

REMINDERS FOR DECEMBER.

LIVE STOCK.

HORSES.—*Stabled Horses.*—Over-stimulating and fattening foods should be avoided. Give water at frequent intervals. Rub down on coming into the stables overheated. Supply a ration of greenstuff, if available, to all horses, or bran mash once a week with 3 or 4 packets of Epsom salts. *Brood Mares.*—Those with foals at foot should be well fed. *Early Foals* may, with advantage, be given oats to the extent of 1 lb. for each month of age daily.

CATTLE.—Provide succulent fodder and plenty of clean water and shade. Limewash the cowbails, it helps to keep down flies. Provide "lick" in trough, consisting of salt 20 lbs., bone meal 20 lbs., and sulphate of iron, 1/2 lb. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Give half-a-cup of limewater in the milk to each calf. Let them have a good grass run or lucerne. Dehorn all dairy calves.

PIGS.—*Sows.*—Supply those farrowing with plenty of short bedding in well-ventilated sties. Those with litters old enough may be turned into grass run. *All* pigs should be given a plentiful supply of clean water. Read articles on breeding and feeding in *Journals* for April, 1912, and June, 1913.

SHEEP.—To ensure an even lambing, ewe flocks should all be of one breed, or as near as possible one cross. See that a sufficient number of rams run with the ewes for six weeks. In cases of non-pregnancy, this period admits of the ewes coming in season the second time whilst with the rams. Merino and fine comeback ewes have been in season for some weeks, whilst crossbred (*i.e.*, first cross) will now begin to come on. Coarse three-quarter-bred ewes, and any approaching the white or black-faced British breeds, will not be in season until towards February. Ewes carry their lambs "four months, four weeks, four days," or, roughly, five months.

POULTRY.—Add a little peameal to morning mash and give less bran. Feed equal parts wheat and heavy oats at night. Supply plenty of green food—at this time, lettuce is invaluable. Discontinue salts and condiments. Avoid salt meat of any description. Put Douglas mixture in drinking water when required. Keep ample supplies of sand, ashes, &c., in pens, and moisten same. This will enable the birds to keep themselves cool and clean. Top off geese, ducks, and cockerels for the Christmas markets. Hens will do better this month by having free range. Remove all male birds from flocks, as infertile eggs will keep longer and command a higher price.

CULTIVATION.

FARM.—Cut hay in late districts. Cut oats and barley in early places. Finish planting potatoes. Put in late maize for fodder, also millet and imphee. Plough fire-breaks where required. Get stackyard and stages ready for hay.

ORCHARD.—Keep the surface loose and free. Suppress weeds. Spray as often as necessary for codlin moth and pear slug. Mulch and spray young trees and grafts with water in the early morning during hot weather.

VEGETABLE GARDEN.—Keep the surface hoed, and allow the plants plenty of moisture. Stake, pinch out, manure, and water tomatoes. Pinch back long runners of pumpkin and melon family. Sow autumn and winter varieties of cabbage and cauliflower. Plant out seedlings in cool weather. Sow French beans. Cease cutting asparagus beds, and top-dress with manure.

FLOWER GARDEN.—Plant out dahlias and gladioli for autumn blooming. Lift and store spring flowering bulbs. Stake, tie, and train growing plants. Sow zinnias and asters. Layer carnations, camelias, daphnes, &c. Water well and keep the surface loose. Keep rose beds fairly dry.

VINEYARD.—Inspect young grafted vines (field or bench) and carefully remove any scion roots. Tie up young vines. Beware of cut worms on young vines—See *Journals* for July, 1911, and September, 1913. Tying up of bearing vines, if practised, should be completed early in month. Avoid excessive and indiscriminate topping, far too frequent in Victoria. Scarify, if soil is not sufficiently loose, and after heavy rain. Look out for oidium and repeat sulphurings on first appearance of disease.

Cellar.—Fill up regularly and keep cellars as cool as possible.

THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 12. 10th December, 1913.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 654.)

PART VIII.—DISEASES.

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

The quantity and quality of the fruit depend on the health of the tree. If trees are starved, the fruit will drop, and the foliage assume a sickly appearance. The foliage should be of a lustrous green colour. Irrigate, cultivate, and manure. Deep-rooting trees properly irrigated have always a plentiful supply of moisture to draw upon, and the roots can perform their proper functions. Well-drained soils and suitable stocks, properly planted and cultivated, will reduce the liability to Root and Collar rot (*Fusarium limonis*), the dread gum disease of the citrus grove. This disease is more prevalent on the lemon than the orange tree. It is a very difficult disease to combat. When the roots are attacked the tree begins to die back from the top, and the foliage assumes a sickly appearance, very often before there is any manifestation of disease on the bark above the ground. Generally, the disease begins on the roots and works upward to the collar of the tree. Examination of the roots will disclose dead and decaying bark which slimes off from the woody part of the root. With badly affected trees, but little can be done. The best plan is to dig them out, roots and all. Burn every part of the tree in the hole from which it is dug, and thoroughly lime the soil before planting another tree. In a mild form, if only one or two roots are affected, and the disease has not reached the collar or butt of the tree, the affected roots should be cut off, thoroughly dug out to the extremities, and the ground where they are dug from limed. The writer's experience of this disease extends over twenty years in all classes of soils, and under all phases of culture, and the experience is that where trees are badly attacked there is no cure. Try to prevent it by planting

trees worked on suitable stocks. Have nothing to do with layers or cuttings; they are always weak and more liable to disease than seedlings, and seedlings of the lemon, as at present supplied, are more susceptible to disease than sweet orange seedlings. Nurserymen should exercise the greatest care in the selection of stock and scion, using only the fittest—strong stock and fruitful scion.

Sometimes only the collar of the tree is attacked. In this case the ruptured bark should be cut away as far as it extends to the roots, cutting back the diseased bark to the healthy green bark, and also cut away the gummy wood with a chisel or sharp knife, until the seat of gumming has been removed. This can be determined by allowing the affected portion to stand exposed for a couple of days. If gum is still oozing from the grain of the wood, as will be seen by streaks of yellow sour sap, the wound should be scraped and cut again, and so treated until the exudation ceases. When this ensues the wound should be treated with crude carbolic acid mixed with its own weight of water. It is generally safe to apply two dressings at an interval of a month, when, if the disease has been arrested, the bark will begin to grow toward the affected part. Should the trees be badly affected with Collar rot, that is, almost encompassing the butt of the tree, the tree is better dug out and burned, and the soil treated with lime. Properly drained soils are absolutely essential in guarding against Root and Collar rot.

Bark-blotch (*Ascochyta corticola*) is easily distinguishable from Collar rot, as there is no gummy exudation at the point of attack. The bark is ruptured as in Collar rot, and in the early stage of attack, if examined under a magnifying glass, numerous pustules of the fungus will be found slightly elevating the ruptured epidermis. As the disease spreads the ruptured bark lifts off from the wood, and if not checked eventually causes the death of the tree. When attacked the trees die back from the top, and put on a sickly appearance.

The treatment for the disease is to cut away the diseased bark to the healthy bark, and lightly scrape the surface of the wood, and treat with crude carbolic as recommended for Collar rot. In using carbolic acid, care should be used so that the vegetable tissues of the tree are not destroyed. The strength of commercial carbolic acid varies; therefore it is necessary to test the strength by practical demonstration. All implements used in cutting and scraping should be dipped in disinfectant after use, and all scrapings, chips, &c., should be gathered and burned, as the diseases are contagious, and may easily be carried to a healthy tree.

The Root-rot Toadstool (*Armillaria mellea*) also attacks the Citrus trees. This disease can be recognised by the black, cord-like strands of mycelium of the fungus, with its branching net-work around the roots of the tree. The branching mycelium enters the roots, and forms a felt-like layer under the bark, and in time the disease causes the death of the tree. The first symptoms of this disease is a dying back from the top of the tree, and sickly appearance of the foliage. The fructification of this fungus can be observed above ground by clusters of toadstools produced around the butt of the tree.

For the checking and eradication of this disease isolation is necessary, as the mycelium spreads through the soil in search of other victims. Trees affected with this disease should be thoroughly dug out and burned in the hole from which they are removed. A deep trench should be dug round the tree to the outermost limit of its roots, making a ring round the affected tree, and all the soil inside this ring thoroughly turned over and saturated with sulphate of iron dissolved in water at a strength of 1 lb. to 5 gallons; or sulphate of copper at a strength of 1 lb. to 8 gallons. This fungus lives as a saprophyte on dead and decaying wood, and changes to a parasite on many of our orchard trees; hence it is always necessary to clear the soil of roots and stumps of forest trees before the planting of an orchard is entered upon. The writer's experience of this disease is that it is almost impossible to cure affected trees, and the best course to pursue is, as advised, to safeguard the adjoining trees.

Wither-tip (*Phoma omnivora*).—The symptoms of this disease are the withering of the tips of the stem and leaves, or the "Die back" as it is called. Frost and cold winds may injure many shoots, but Wither-tip is recognised by the greyish-brown discoloration of the leaves, and the dark brown or blackish blotching of the twigs, and brownish-black scab on the fruit. The remedies to be applied to prevent this disease are—encourage healthy root action, cut back all diseased parts to a healthy growth, spray with Bordeaux Mixture or copper soda, burn all prunings, and avoid the use of organic nitrogenous manure, such as fresh stable manure, immediately around the tree, especially in the autumn, as this causes a soft growth of foliage particularly subject to disease.

Black Spot (*Phoma citricarpa*); Scab of the orange and lemon (*Cladosporium subfusoideum*, *Diplodia citricola*, *Sporodesmium griseum*); False Melanose (*Cladosporum brunneo-atrum*); Black Scurf (*Coniothecium*), and various fungi, such as *Pleospora disrupta* and *Diplodia destruens*, enumerated under the general names of Leaf Scab, Blister and Curl—any of these fungi may attack the Citrus grove, and all are amenable to treatment by spraying with the fungicides mentioned.

Sooty Mould (*Capnodium citricolum*) is always found in conjunction with brown and black Scale (*Lecanium*). Keep the trees free from Scale and there will be no Sooty Mould.

The fungus diseases mentioned are the chief ones the grower will have to contend with in the orchard, and he should make himself thoroughly conversant with them. *Fungus Diseases of the Citrus*, by D. McAlpine, contains coloured plates and explanations, and is obtainable from the Department of Agriculture, Melbourne. Price, 2s.

Bordeaux Mixture—

Sulphate of Copper, 6 lbs.
Fresh lump lime, 4 lbs.
Water, 40 gallons } prepared as follows—

Dissolve the bluestone in 20 gallons of water, and slake the lime into a paste, and make up to 20 gallons with water. When the bluestone is dissolved, and the lime taken up in the water, add the two together by pouring them simultaneously into a third vessel through a good strainer.

Spray on cool, cloudy days when the foliage is perfectly dry, and when the young growth on the tree has hardened. The formula given is winter strength; if using in the summer, use half the strength.

Copper Soda Mixture—
Sulphate of Copper, 6 lbs.
Washing Soda, 9 lbs.
Water, 50 gallons
} prepared as follows—

Dissolve the bluestone in 25 gallons of water, and dissolve the soda in 25 gallons of water, and mix as for Bordeaux. The summer strength is 6—9—100.

Spraying is best carried out in early August, but if the fruit is affected, then summer and autumn spraying will be necessary.

Rot, or Blue Mould of the Orange and Lemon.—This fungus is known under the name of (*Penicillium digitatum*). It is a disease only of the fruit, and is found chiefly in the packing and curing shed, and in packages of fruit. In the packing and curing sheds, or in the packages, the disease generally begins where two fruits press together, or on any bruised portion of the fruit. Navel oranges may be attacked in the orchard, the disease beginning at the navel end; it may also occur subsequent to any wound on the surface of the fruit. Under favorable conditions, the disease soon spreads. The conditions favorable to its development are moisture on the surface of the fruit sufficient to cause germination of the spores under right degrees of temperature, the range of which is extremely great, and can almost be said to be always favorable. The spores gain an entrance to sound fruit by contact with spores produced on rotting fruit. The presence of moisture on the fruit is always necessary for the germination of the spores, consequently fruit removed after refrigeration should be immediately dried by quick ventilation. Packing and curing sheds should also be thoroughly ventilated so as to carry off any moisture that may accumulate during the sweating process. The surest means of spreading this fungus is by piling diseased fruit in heaps in the vicinity of packing and curing sheds. The fruit should be destroyed by burning or burying before it reaches the blue mould stage. If fruit is wrapped in tissue paper it will be found efficient only within certain limits for preserving it from infection. When the temperature falls, the paper becomes moist, and this moisture is evaporated when the temperature rises, therefore by good ventilation the moisture will be carried off; on the other hand, should the fruit sweat, and the paper become very wet, owing to rapid decrease in temperature and bad ventilation, water will gather on the fruit; and if disease spores be present rapid germination of the spores will ensue.

In packing and curing sheds cleanliness should be the first essential. All litter and rubbish should be destroyed by burning; and the sheds, along with all boxes, trays, &c., connected with them, should be thoroughly fumigated with sulphur fumes. For this purpose the sheds should be rendered as air-tight as possible.

In the summer, when there is no fruit in the sheds, they should be thoroughly opened and exposed to the influence of hot, drying winds. Cleanliness, dry air and sunshine are the enemies of Mould fungi.

Chlorosis, or yellow and variegated leaves, is usually caused by a want of iron in the soil. Individual trees treated with sulphate of iron

in powdered form, at the rate of 3 lbs. to the tree, have done remarkably well afterwards. Iron in an available form is not always present in the soil, and a dressing every few years of 1 cwt. to the acre is of direct benefit to the grove; it enriches the colour of the fruit, and produces a deep green tint in the leaves. Sometimes there are other causes affecting the colour of the foliage, such as too free and gravelly soils, which dry out too quickly and do not retain sufficient moisture for the tree. Hardpan is another cause; also bad drainage, causing stagnation. All symptoms of disease should be inquired into immediately.

Of Insect diseases affecting Citrus trees, the Red Scale (*Aspidiotus aurantii*) is undoubtedly the most troublesome. The insect itself is very tiny, yellow to brownish in colour, and is covered with a circular flat scale, grey to red and about the size of a pin's head in the female, and red in colour and about one-third the size of the female in the male. The insect attacks the fruit leaves and bark, and the only effectual remedy for it is fumigation with hydrocyanic gas.

Black Scale (*Lecanium oleae*) is also a very troublesome insect; it is called the olive scale, and is very injurious to the olive tree, also the oleander. These trees, should they be growing near an orange grove, should be watched; and if scale is found, they should be treated by fumigation or sprayed with a scalecide. The olive scale is dark brown, almost black in colour, and hemispherical in shape, and attacks the leaves and bark chiefly. The secretion from the Scale (Manna or honeydew) is always indicated on infested trees by the black discoloration on the leaves, bark and fruit. Fumigation or spraying with resin wash will be found effective, and should be carried out in February or March, when the young scales are appearing. Dense foliaged trees are always more infested with Scale than trees with well-spaced branches, open to the admission of light and air. There are other varieties of *Lecanium* affecting Citrus trees; also the Cottony Cushion Scale (*Icerya Purchasi*) is sometimes met with. The same treatment is recommended for all. Trees affected with Scale soon become unprofitable.

Resin Wash—
Resin, 20 lbs.
Caustic Soda (70 per cent.), 7 lbs.
Fish Oil, 3 pints
Water, to make 100 gallons
} prepared as follows—

Place the resin, soda and oil in a boiler and add 20 gallons of water, and boil thoroughly over a brisk fire for about three hours, then add hot water occasionally, and keep stirring the mixture until diluted or made up to 50 gallons of hot mixture. Place this in the spray vat and add cold water to make up to 100 gallons. Cold water is not used while preparing the mixture. Keep the mixture well agitated while spraying, and use long gloves over the hands and arms. After using resin wash, all vessels, spraying machines, and nozzles should be washed out with cold water to prevent clogging for future use.

Hydrocyanic Gas—
Cyanide of Potassium, 98 per cent., 1 oz. by weight
Sulphuric Acid (Common commercial), 1 oz. fluid
Water, 2 oz. fluid
to every 180 cubic feet of space.
} generated and used as follows—

The ingredients are placed in a glazed earthenware or enamel vessel of fair size, and the tree covered with an air-tight tent to hold the fumes generated.

Briefly, the method is as follows:—The tree is first covered with the tent, and the edges secured on the ground by covering with earth. On the windward side, the operator places the generating vessel under the tent, and places the water in the vessel, then the sulphuric acid is slowly added, and last of all the cyanide; the tent is secured, and the fumes allowed to generate for about 45 or 50 minutes. This work is best carried out at night, or on cool, cloudy days. The foliage of the trees must be perfectly dry, otherwise burning will result. Simultaneously with dropping the cyanide in the generating vessel, a piece of bagging should be thrown over the vessel to spread the fumes, and prevent burning of the foliage immediately above the vessel. Cyanide should be used in coarse pieces; the coarser it is the more gently the gas is generated. If used too fine, the gas in generating spatters the ingredients outside the vessel. Hydrocyanic gas is a deadly fume, and great care should be exercised in its use. A complete article on quantities, tents, and size of trees, appeared in the June *Journal of Agriculture*, 1912, and growers would do well to procure this publication; also get an experienced officer of the Agricultural Department to instruct them in the use of the gas.

Orange Aphis (*Siphonophora? sp.*).—This insect attacks the young tender shoots of the orange and lemon, causing them to wither, turn black and die off. The insects vary in colour, being greyish or dark brown and olive green colour in the wingless stage, and in the winged stage dark leaden grey, with the under wings clear and the upper wings with faint orange-coloured markings. Like all aphides, they multiply rapidly, and in some seasons do a lot of damage to the young growth of the trees. Spraying with Tobacco wash will be found effective in combating this pest, and it should be sprayed for as soon as observed.

Tobacco Wash—
Refuse tobacco, 1 lb. } prepared as follows—
Cold Water, 4 gallons }

Soak the tobacco in the water for two days, stirring occasionally, then strain off the nicotine water and spray. In order to render the nicotine water adhesive, it will be found beneficial to add 1 gallon of water in which 1 lb. of common starch has been dissolved.

In spraying for disease, use pumps provided with good agitators, so that the insecticides and fungicides will be in a constant state of agitation; this will insure proper mixing of the ingredients.

The orchard must be kept clean to procure the best results, and attention to details, along with methodical management, will greatly minimize the risk from disease, both insect and fungi.

BEE-KEEPING IN VICTORIA.

(*Continued from page* 660.)

By F. R. Beuhne, Bee-Expert.

XIX.—UNCAPPING COMBS.

Before the honey can be extracted from the combs of the modern frame hive, the wax caps with which the bees have covered the cells of

Fig. 1.—Uncapping Combs into Simple Melter.

honey have to be removed. This is done by means of what is known as an uncapping, or honey, knife—a stout knife 8 to 12 inches in length with two cutting edges, bevelled from one side, and an off-set handle. To uncap quickly and without damaging the combs, the honey knife should be as sharp as a razor and must be kept in hot water so that it will easily pass the comb surface on one side and the sheet of cappings on the other. Two knives may be used with advantage, so that while the operator is working with one, the other is getting hot for the next comb. There are several different knife-heaters, one of which, seen in the illustration (Fig. 3), is heated by a small lamp. When a cappings melter is used, a

separate knife-heater is not required, the knives being hung into the hot water of the apparatus as shown on the left in Fig. 2.

The uncapping of the combs and the extracting of the honey should be done as soon after the combs are taken from the hive as possible, if the weather is at all cool, unless a warm room is available in which to

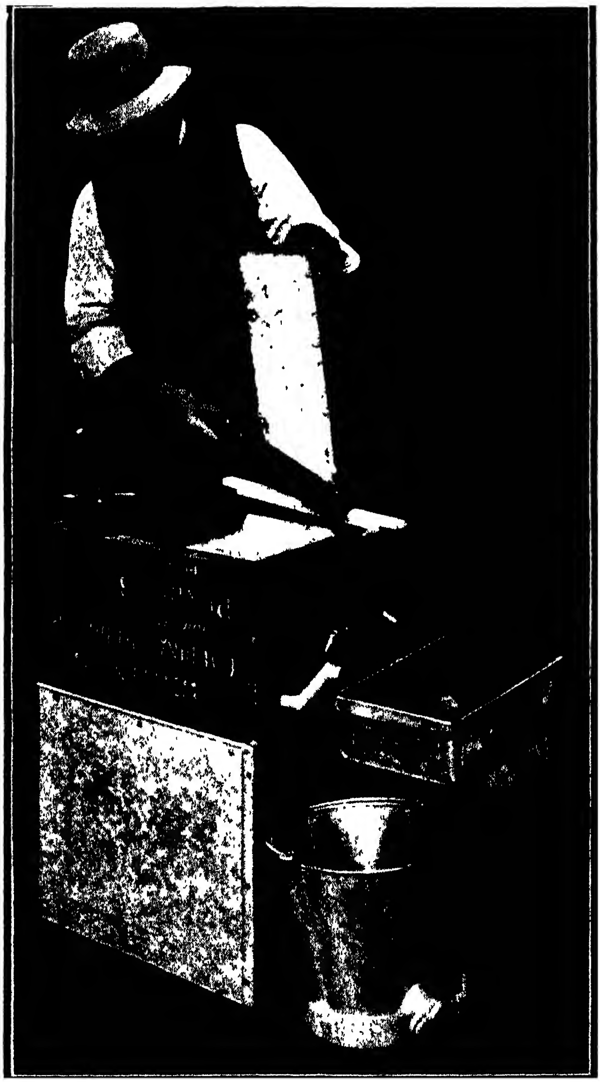


Fig. 2.—Uncapping into Patent Cappings Reducer.

keep them. Combs uncap and extract best at the temperature they are in a hive crowded with bees.

There are different ways of uncapping combs, cutting upwards or downwards, crossways of the frame or lengthways; but in each instance the bevelled edge of the knife is towards the comb, the severed cappings

passing over the broad face of the knife. The majority of operators use the upward stroke; the frame is placed on end over the cappings receptacle, the knife is started at the lower side bar of the frame and with a slightly sawing motion drawn upwards, the top and bottom bars of the frame acting as a guide to the bevel of the knife, if a long one is used.

Fig. 3.—Uncapping Can. Wrong way of holding Comb.

To prevent the severed cappings falling back against and sticking to the surface of the comb, the frame should be tilted slightly forward, as in Fig. 2. Before returning the knife to the hot water it should be drawn across the edge of the wooden frame support to free it of honey and wax. The hand holding the frame should be kept back behind the wood of the

frame, as in Fig 1, to prevent cutting it should the knife slip at the end of the cut. Uncapping, as in Fig. 3, is likely to result in damage to one's fingers. To keep the honey knife in good order, the edge used for uncapping should not be utilized for trimming burr combs off top or bottom bars where nail-heads are likely to be met. The knife should not be left in the heating water during intervals in the work; and when being sharpened should be ground from the bevelled side only, and brought to a fine edge with an oil-stone.

A receptacle into which the cappings drop as they are shaved off the combs is necessary. The simplest form consists of a vessel with a perforated bottom through which the honey drains into a lower receptacle. For larger apiaries a trough, with a perforated false botton an inch above the real one, and a honey gate at one end, will be found more serviceable. It should be large enough to hold the cappings of a day's work, as they

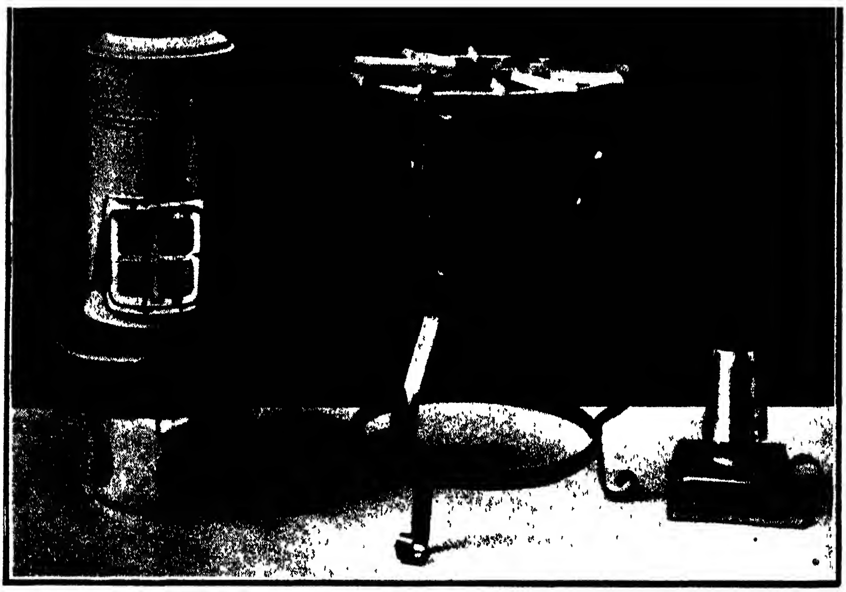


Fig. 4.—New Perfection Oil Stove for Heating Capping Melters.

drain very slowly; they should be broken up and worked about now and again to hasten draining. In Fig. 3 an uncapping can is shown, the honey from the cappings drains through a wire screen and is drawn off through a honey gate at the bottom.

Even when allowed to drain for several days, a considerable amount of honey remains in the drained cappings, and although this is recovered when the material is melted down for wax, it is dark in colour and of a waxy flavour. The drained cappings are usually transferred to the solar wax extractor, a tin-lined box covered with a pane of glass facing the direct rays of the sun, and in which the wax melts and liberates the honey. Cappings are, however, awkward and slow to handle, and as the solar extractor does not work on cloudy or hazy days, accumulations occur during the busy season. By means of cappings melters, all handling of this sticky material is dispensed with, the cappings are melted as fast as they are sliced off, and honey and wax separated.

Several different types of reducers, as cappings melters are called, are on the market. The simplest form is that shown in Fig. 1, and consists of two metal cans, one inside the other, with a space for water between them. It is heated from the bottom by a kerosene stove placed under the stand, a double wire screen prevents unmelted wax escaping by the outlet gate, while the honey knife is kept hot in an opening between the inner and outer can. Honey and wax flow out into the receiving vessel together, and separate owing to their different specific gravity. The wax is allowed to set on top of the honey, and thereby imparts a flavour to the latter. This apparatus is known as the "Simple Cappings Melter."

For apiaries of fifty colonies and over it is best to have the "Patent Cappings Reducer," illustrated in Figure 2. It is composed of an outer and an inner metal casing forming a jacketed space for water between the two. Two opposite sides are connected transversely by square tubes set ⅛ inch apart forming a grid. This apparatus is made of copper, which is tinned where it comes in contact with honey or wax, while it is encased in wood to conserve heat. It rests on an iron stand, and is heated by a kerosene stove. The cappings, as they leave the honey knife, fall on to the grid of tubes, on which they quickly melt in contact with the hot metal, the resulting liquid passing through between the tubes into the receiving tray in the lower part of the machine. This receiver is made of stout tin, in the shape of a drawer, with a board front. At its lowest point it connects with an elbow swivel tube on the outside, which is set to the correct elevation to keep the level of the liquids in the tray slightly below the wax outlet tube on the upper part of the receiver. Before commencing work sufficient honey is put into the receiver to cover the end of the honey tube inside the tray. As liquid wax and honey accumulate, and the level of the upper and outside end of the tube is reached, honey will commence to flow from the elbow tube, while the liquid wax, owing to its lesser specific gravity, floats on top of the honey, and gradually rising overflows into a mould placed underneath the wax outlet tube in front of the machine.

The elevation of the honey tube should be such that while a continuous overflow of honey and wax is maintained during uncapping of combs, both liquids should run from the machine free from impurities, the dross, of which there is a considerable quantity when old black combs are uncapped, should remain in the tray. Before uncapping the last super of combs the honey-tube may be slightly raised to force as much wax out of the wax tube as can be got out clean; when all the cappings have disappeared through the grid the honey tube is gradually lowered, and the honey allowed to run till the first indications of impurities appear, when it is turned up. The cake of dross, which still contains a little wax, is removed from the tray when cold, sufficient honey generally remains to cover the end of the honey tube ready for further work. From what has been said, it will be seen that the well-known U tube principle is employed to effect continuous automatic separation of liquids of different specific gravity; the receiver representing one arm of the tube and the elbow tube the other.

A stove is needed to keep the water in the machine at boiling point. A Primus stove may be used, but, while it will work quickly, it will give rather too much heat when used in full blast, and requires occasional pumping up and pricking. The New Perfection Blue Flame Oil Stove,

illustrated in Figure 4, will be found the most satisfactory means of heating cappings melters. It takes somewhat longer than the Primus stove to bring water to the boiling point, but the heating power can be adjusted to a nicety, and, if handled according to the instructions supplied with it, requires no attention whatever. Under the Patent Cappings Reducer it is used without the iron stand supplied with it, so that the funnel may project through the circular opening in the top of the Reducer stand. Under this Reducer the stove rests on a support, as shown on the left of the illustration (Figure 4). For other purposes it is used in the stand shown in the centre.

(*To be continued.*)

FRUIT PROSPECTS FOR THE SEASON 1913-1914.

P. J. Carmody, Chief Orchard Supervisor.

To give some indication of the fruit crop for the season 1913-14 the reports of the district supervisors are given hereunder. The season at the outset gave excellent prospects of a good harvest, but boisterous and bitterly cold weather at the time of setting of the apples has had an injurious ffect on this particular kind of fruit. Even at the time of writing one cannot speak with any degree of certainty of the prospects; but, judging from the reports forwarded, an average crop can be looked for. In many cases striking evidence is offered of the advantage of having Jonathans mixed up with other varieties to influence their setting. The crop of apricots will be much heavier than last year, when the crop in the Goulburn Valley failed. Owing to the inclemency of the weather at setting, grave danger exists as to the freedom of the fruit from Black Spot, particularly where thorough spraying has not been carried out.

Prospects of the season's fruit crop, 1913-14, in the Doncaster district. A. A. Hammond, Orchard Supervisor—

Apples.—Good to very good. Jonathans very good. London Pippin and Rome Beauty just setting at time of writing. They promise a good setting.

Apricots.—Heavy. Not much grown in district.

Cherries.—Generally good. Early cherries light in some places.

Pears.—Medium to good. Williams' Bon Chretien light in many orchards, particularly on old trees that bore heavily last season.

Peaches.—Medium to good. Early peaches light in some orchards; very light in Wandin North.

Plums.—Medium to good, Angelina light. Generally fair crop of leading varieties.

Quinces.—Good.

Strawberries.—Good.

Prospects of fruit crops, season 1913-14. J. Farrell, Orchard Supervisor—

Bayswater.—Apples: All varieties medium to heavy. Pears: Williams' Bon Chretien, medium to light; Keiffer's Hybrid, medium; Napoleon and Howell, medium to heavy; other varieties, fair crop. Plums: Angelina Burdett, light; other varieties, medium. Peaches: Briggs' Red May and Hale's Early, light; other kinds, medium.

Blackburn.—Apples: All varieties medium to heavy. Pears: Medium to heavy. Peaches: A fair crop. Plums: Medium.

Brighton.—Apples: All varieties good. Pears: Williams' Bon Chretien heavy; other varieties, medium. Peaches: Medium to light. Figs: Medium (first crop).

Burwood.—Apples: Jonathan, medium to heavy; others, a good crop. Pears: A good crop, except in places; Williams' Bon Chretien, rather light. Peaches: Mostly light. Plums: A fair crop.

Croydon.—Apples: Jonathan has set well; Five Crown and Rome Beauty are also setting a good crop; other varieties mostly medium. Pears: Williams' Bon Chretien, medium to heavy; Keiffer's Hybrid, medium to light; Howell, heavy; others, a fair crop. Peaches: Light. Plums: Medium to heavy.

Emerald.—Apples: Five Crown and Rome Beauty are setting well. Jonathan, medium. Pears: Medium. Plums· Medium.

Fern Tree Gully.—Apples: Jonathan, Reinette du Canada, Yates, Esopus Spitzenberg, heavy; others, medium to heavy. Pears: Williams' Bon Chretien, heavy; Beurre Bosc and others, medium. Plums: Medium to heavy. Peaches: Medium.

Monbulk.—Apples: A fair crop. Pears: Light to medium. Plums: Wickson, light; Burbank, heavy; others, light to medium. Peaches: Light to medium. Nectarines: Light. Raspberries: All kinds heavy. Gooseberries: Roaring Lion heavy, as usual; others, medium to heavy. Currants: Red and white, heavy; black, light to medium.

Ringwood.—Apples: Jonathan, a good crop; Yates, Esopus Spitzenberg, Rymer, Reinette du Canada, and others, good; Rome Beauty and Five Crown setting well. Pears: Keiffer's Hybrid, light; Howell, Napoleon, Beurre Bosc, Beurre Capiaumont, heavy; Williams' Bon Chretien, medium. Plums: Medium to heavy. Peaches: Briggs' and Hale's Early, rather light; other kinds, medium. Quinces: Medium to heavy. Gooseberries: Heavy.

Scoresby.—Apples: Most kinds, medium to heavy. Pears: A fair crop. Plums: Medium to heavy.

Vermont.—Apples: All kinds, medium to heavy. Pears: All varieties, a good crop. Plums: Medium to heavy. Peaches: Light. Lemons and oranges: Medium.

Wandin.—Apples: Jonathan, medium; Sturmer Pippin, Reinette du Canada, medium to heavy; Rome Beauty and Five Crown, setting well; others, light to medium. Pears: Williams' Bon Chretien, light to medium; Beurre Bosc, Beurre Capiaumont, Beurre Clairgeau, medium; others, light to medium. Peaches: York, medium to heavy; Comet, light to medium; Briggs' Red May and Hale's Early, rather light. Plums: Burbank, medium to heavy; Wickson, light; also Angelina Burdett; Grand Duke, Diamond and others, mostly medium. Oranges and Lemons: Medium to light. Quinces: Heavy. Loquats: Medium to light. Walnuts: Light. Almonds: Light. Mulberries: Heavy. Figs: Light (first crop). Passion Fruit: Light. Raspberries: Owing to favorable weather conditions, will be heavy. Blackberries: Heavy. Loganberries: Heavy. Gooseberries: Heavy. Currants: Red and white, heavy; black, light. Filberts: Light.

Waverley.—Apples: All kinds, medium to heavy. Pears: All varieties, a fair crop. Plums: Medium. Peaches: Light. Lemons and Oranges: Medium.

Fruit crop prospects at Arthur's Creek, Bacchus Marsh, Diamond Creek, Kangaroo Ground, Keilor, Panton Hill, Queenstown, Research, Werribee, and Whittlesea, season 1913-14. E. Wallis, Orchard Supervisor—

Apples.—Medium to heavy, average crop; Jonathans, heavy.
Apricots.—Medium to heavy, average crop.
Cherries.—Medium to heavy, average crop.
Gooseberries.—Medium to heavy, average crop.
Peaches.—Light crop.
Pears.—Medium, average crop.
Plums.—Medium, average crop.
Quinces.—Medium, average crop.

Fruit crop prospects, Goulburn Valley, season 1913-14. A. G. McCalman, Orchard Supervisor—

Pears—

The Williams' Pear is the only variety largely grown in the district. Blossoming was almost invariably heavy, and up to the beginning of November the prospect of a heavy yield was excellent. Then, however, the bulk of the young fruits dropped. The crop will be on the light side.

Josephine de Malines.—These blossomed heavily. The yield will be good.
Vicar of Winkfield.—The yields will be fair only, crops being patchy.
Beurre d'Anjou and *L'Inconnue.*—These will give heavy yields.
Beurre de Capiaumont.—Show good crops, but not heavy.
Beurre Clairgeau.—Show light crops.
Winter Nelis.—Show a medium crop generally; in some cases heavy.
Gansell's Bergamot.—Show fair crops.
Keiffer's Hybrid.—Show light crops.

Apples—

Jonathans.—These will be fairly good.
Cleopatra.—These, also, will be fairly good.
Dumelow's Seedling.—These are patchy; will give a medium crop only.
Bismarck.—Show a light crop; blossom was poor.
King of Pippins.—Patchy; medium crop only.
Fire Crown.—Bloom was heavy, but many blooms are falling; will be only a medium crop probably.
Rome Beauty.—Bloom was heavy; will probably be a fair crop.
Irish Peach.—Show heavy crops.
Northern Spy.—Show heavy crops.
Reinette du Canada.—Show light crops only.
Ribston Pippin.—Show medium crops.
Yates' Pippin.—Show medium crops.
Rymer.—Patchy; medium crops.
Ben Davis.—Good crop.

Plums—

French Prune.—Promise heavy yields. This is the only plum extensively grown.
Coe's Golden Drop.—Show good crops.
Pond's Seedling.—Show good crops.
Black Diamond.—Show good crops.
Early Orleans.—Show good crops.
Angelina Burdett.—Very light.
Green Gage.—Good crops.
Prune Splendour.—Good crops.

Japanese Hybrid Plums—

All varieties yielding well. *Gold, Golden Heart, Wickson,* and *Satsuma* being chiefly grown.

Cherries—

The early varieties have been harvested, giving medium yields. *Early Purple Guigne Early Lyons.*
Bedford's Prolific.—Will be heavy.
Florence.—A medium crop.
St. Margaret.—Light crop.
Twyford Biggareau.—A good crop.
Black Biggareau.—A good crop.

Quinces—

Apple Shape.—Show heavy crops.
Pear Shape.—Show heavy crops.
Grapes, including *Zante Currants* and *Sultanas.*—These all promise excellently, but the bloom is not yet out.

Summary—

Peaches.—All varieties will yield heavy crops.
Apricots.—Up to the present, the loss of fruit at stoning period is slight. The crop may be classed as good, though not heavy; Moorparks are patchy.
Pears.—The yield will be on the light side, owing chiefly to the Williams' not setting well.
Apples.—The yield will be medium.
Plums.—The yield will be heavy for both European and Japanese varieties.
Cherries.—The yield will be fairly good.
Quinces.—The yield will be heavy.
Grapes, including *Zante Currants* and *Sultanas.*—Promise very well, but it is too early to judge.

Prospects of fruit crops for season 1913-14. W. P. Chalmers, Orchard Supervisor—

Dunolly, Bet Bet, St. Arnaud.—Plums: Light. Peaches: Early, light; late, medium. Cherries: Good. Apricots: Heavy. Pears: Medium.

Amphitheatre, Elmhurst, Eversley, Pomonal, Stawell, Ararat.—Apples: Heavy. Grapes: Heavy. Pears: Good. Plums: Medium.

Horsham (Quantong and Riverside).—Apricots: Early Oullins, heavy; late, canning, light to medium. Peaches: Light to medium. Plums: Good. Apples and Pears: Good. Grapes: Heavy.

Prospects of fruit crops in the North-Eastern districts, season 1913-14. C. F. Cole, Orchard Supervisor—

Yackandandah and Beechworth Districts.—Apples: Medium to light. Pears: Light. Plums: Light. Japanese Plums: Medium. Peaches: Medium to heavy. Cherries: Medium. Almonds: Medium to heavy. Lemons: Medium to heavy. Walnuts: Promising well.

Rutherglen and Wahgunyah Districts.—Peaches: Medium to heavy. Apricots: Light. Cherries: Heavy to medium. Pears: Light. Apples: Medium to light. Plums and Prunes: Light. Almonds: Medium. Nectarines: Medium to heavy.

Springhurst, Barnawartha, Wodonga, and Districts.—Peaches: Medium to heavy. Almonds: Medium to heavy. Apricots: Medium to light. Cherries: Medium to heavy. Pears: Light. Plums and Prunes: Light. Nectarines: Medium to heavy. Apples: Medium to light. Lemons: Medium to heavy.

Kiewa and Tallangatta Districts.—Apples: Medium to light. Pears: Light. Plums: Light. Japanese Plums: Medium to light. Peaches: Medium to heavy. Walnuts: Promising well.

Euroa and Strathbogie Districts.—Apples: Medium to light. Pears: Light. Peaches: Medium. Lemons: Medium to heavy. Plums: Light.

Most varieties of apples and pears carried a heavy crop last year. Although they showed well for this season, a light to medium crop is anticipated by growers. Plums and prunes set a light crop, although blooming well—also apricots.

Prospects of fruit crops, season 1913-14, Bendigo and Northern districts. S. A. Cock, Orchard Supervisor—

Apricots in all districts have set an exceptionally heavy crop, probably the heaviest on record in all varieties.

Apples promise a fair to heavy crop. All varieties have a fair setting, and all districts promise well.

Almonds are not largely grown commercially, but trees have set a good crop.

Cherries have set a heavy crop in all varieties at Castlemaine and Bendigo.

Currants.—Red, Black, and White have set a good crop.

Citrus.—Oranges and lemons are flowering well, and a good crop should result.

Gooseberries.—Campbell's Creek and Castlemaine are the chief districts for this fruit, and the crop is very heavy.

Grapes promise a very heavy crop at Bendigo and the Murray districts.

Peaches.—A heavy crop in all varieties in Bendigo and the Murray districts.

Plums.—Probably the heaviest crop known in the Castlemaine and Bendigo districts in all varieties.

Pears.—An extremely heavy crop has set in all districts; at Harcourt, Winter Nelis being probably the heaviest crop known. Gansel's Bergamot has also set a heavy crop.

Quinces.—A heavy crop.

Strawberries.—At Campbell's Creek and Castlemaine a heavy crop; also Bendigo and Rochester.

Tomatoes.—A record planting. There has been a total immunity from frosts, and the crop promises to be a very heavy one at Echuca, Swan Hill, Kerang, Rochester, and Bendigo.

Miscellaneous.—Loganberries, Raspberries, Loquats and Persimmons have promise of good crops where grown.

It is estimated that fully 1,500 acres of orchard trees have been planted in this district this season, consisting chiefly of citrus (oranges

and lemons), peaches (chiefly cannng varieties), apples and pears (export varieties), apricots and plums, the latter including a large area of prunes. Generally speaking, the orchards are looking well, and the trees well and skilfully cultivated.

The reports from Gippsland, Somerville and the Western District show that the crops are somewhat similar to the foregoing; and in no place are they promising as heavy as the past season, when a record crop was harvested.

DIFFICULTIES IN MANAGEMENT OF CO-OPERATIVE CONCERNS.

Harold G. Powell, General Manager of the Californian Fruit-growers' Exchange, writes:—

"A co-operative organization is more difficult to manage than an ordinary corporation. In the latter, the stockholders do not often take an active interest in its management, because they are not experts in the business of the corporation. . . .

"There are two extremes in the method of managing a co-operative organization of farmers; one is a method in which the manager becomes an arbitrary dictator in developing and executing the policies of the association similar to the method in many stock corporations; in the other, the directors establish the policies and execute them through a clerical assistant. Either system is almost certain to fail in the end. Neither is founded on principles that are adapted to a farmers' co-operative organization.

"Between the two extremes lies the successful method of management. The manager who succeeds is he who holds the confidence of the directors and the interest of the members, and who shapes them into a working policy, who acts on matters of policy only after the approval of the directors, and who, at the same time, takes the initiative in the development of a progressive, constructive business policy for the directors to adopt. . . . Again, from the standpoint of the association itself, no co-operative organization can succeed if the directors are unwilling to place its business management in the hands of a strong, aggressive, thoroughly experienced, well-paid man and to carry out all of its policies through him alone. . . .

"Of all the different factors that have been contributory, no single factor, unless it is the disloyalty of the members themselves, or the meddling of the members in the duties of management, has operated so strongly against the success of farmers' business associations as the low salaried, inexperienced, incompetent managers selected by the directors to handle these organizations.

"This position is not a place to be filled by a popular local leader who has often failed in business, or who has been only moderately successful. There are many association managers of this type. They are 'good fellows,' but they often stand in the way of real progress in the co-operative movement because they have none of the elements of leadership or do not possess convictions of a kind that lead to the up-lifting of the co-operative method."—*Co-operation in Agriculture*, pp. 36-39.

INSECT PESTS OF THE POTATO.

C. French, Jr., Government Entomologist.

[This article appeared as an appendix to Mr. D. McAlpine's *Handbook of Fungus Diseases of the Potato in Australia and their Treatment.*]

Introduction.

Many of the insect pests of the potato known to science are found in Victoria, though, fortunately, we have not the dreaded Colorado beetle and some others which are prevalent in America and elsewhere. With the careful inspection and quarantine in Melbourne of all potatoes arriving from abroad, growers have now less fear of new pests being introduced. Should any such appear it would be advisable to at once send specimens to the Department of Agriculture, in order that action may be taken for its suppression.

Many native insects whose natural food is being destroyed as new land is brought under cultivation are turning their attention to the potato and other crops, so growers should always be on the alert. With the modern outfits, the spraying of crops is now an easy matter, and most of the chemicals used are obtainable at a reasonable price.

Most of the insects described in the following pages are known to growers, and on this account their technical descriptions have been curtailed.

THE POTATO THRIP.

(*Thrips tabaci*, Lindemann.)

During the last few years these destructive little insects (probably introduced from Europe) have caused growers considerable losses, and they are unfortunately on the increase. They attack plants of all kinds.

If *débris* in sheltered places is examined during the winter months, the thrips will occasionally be found in great numbers. They are very slow in their movements, and a severe winter is the means of lessening their numbers considerably as they cannot stand cold wet weather.

Where they have survived the winter the first warm day in October brings them out. They then appear in millions as if by magic. If the potato leaves are examined underneath the thrips will be found in all stages of development. The lower leaves of the plant are generally attacked first, and, as these are destroyed, the top ones are affected in turn. In a short time the whole plant shrivels up, and the potatoes are often only the size of marbles.

In Victoria the life cycle of these insects is as follows:—Development of egg, 3 to 4 days; development of larva, 7 to 10 days; development of nymph, 4 days; total development, 10 to 15 days. In other countries they have taken as long as 47 days to develop. Should the weather be warm, the eggs will of course develop more quickly than in cold weather. They are deposited in slits or other well concealed positions on the stems and foliage.

Prevention and Remedies.

The thrip pest is indeed a serious one, and growers will sooner or later be compelled to take united action against it, otherwise it will be almost impossible to grow good crops.

All *débris*, such as dried potato plants, weeds, &c., on potato fields should be gathered up and burnt. By this means the hibernating insects and their eggs will be destroyed.

During 1910, Mr. G. Seymour, Potato Expert, and the writer carried out some experiments at Romsey against thrips. A Strawsonizer spraying outfit was used. This was fixed in a dray and worked very satisfactorily, the spray being forced up under the leaves so that the plants received a good soaking. Tobacco water was used with good results. This wash requires careful straining, otherwise it is liable to choke the nozzles of the pump, and that would leave many plants unsprayed. The formula for tobacco wash is as follows:—Steep 1 lb. of tobacco in 1 gallon of hot water, and allow it to soak for 24 hours; boil 1 lb. of soap in 1 gallon of water until the soap is dissolved; strain the tobacco water into the soap water; stir well, and make up to 5 or 6 gallons. Use waste stems of tobacco.

Benzole emulsion, a cheap preparation, costing about 4d. per lb. wholesale, has proved very effective. One lb. makes 5 or 6 gallons of spray, and every insect reached by this mixture is killed at once. Now that many motor spray pumps are on the market, the work of spraying can be done thoroughly and in a short space of time.

Hellebore or a weak kerosene emulsion, has also given good results as a spray fluid. In America the use of lime in the following proportions has been highly recommended:—35 lbs. of lime to 100 gallons of water. In other cases, a stronger spray using from 50 to 75 lbs. of lime to 100 gallons of water was used with the best results.

The potato thrips and its control has been the subject of experiments conducted in America by Mr. Dudley Moulton. The results are detailed in Bulletin 80, published by the United States Department of Agriculture. Thrips which attack other kinds of plants and trees may be combated by the same remedy which he gives for the potato thrips. From an extensive series of trials of various kinds of spray fluid, Mr. Moulton comes to the conclusion that, though tobacco leaf extract, one part to 50 of water, is very successful, yet a more penetrating and hence more effective material is got by making up the tobacco leaf extract with an oil instead of with water only. The oil spray is forced more easily than the water spray into the buds, and penetrates more readily the oily covering of the insects themselves. The oil spray recommended is composed of:—Distillate oil emulsion, 1½ to 2 per cent. solution; black leaf-tobacco extract, 1 part to 60 parts of water. The distillate oil emulsion is prepared as follows:—Hot water, 12 gallons; white oil or fish oil soap, 30 lbs.; distillate oil (23 degrees, Baume), 20 gallons. The soap is dissolved in a kettleful of boiling water, and poured into the spray tank; the oil is then added, and the mixture is agitated violently, and sprayed under a pressure of 125 to 150 lbs. into other barrels. This stock solution is diluted before use with 24 gallons of water to each gallon of solution.

As a deterrent against thrips, spraying with coal-tar water has been recommended. The formula is as follows:—Boil 1 lb. of coal-tar in 2 gallons of water, and, while hot, add from 50 to 100 gallons of water.

Several of the accompanying illustrations have been reproduced from *The Destructive Insects of Victoria*, by C. French, F.L.S., F.E.S.

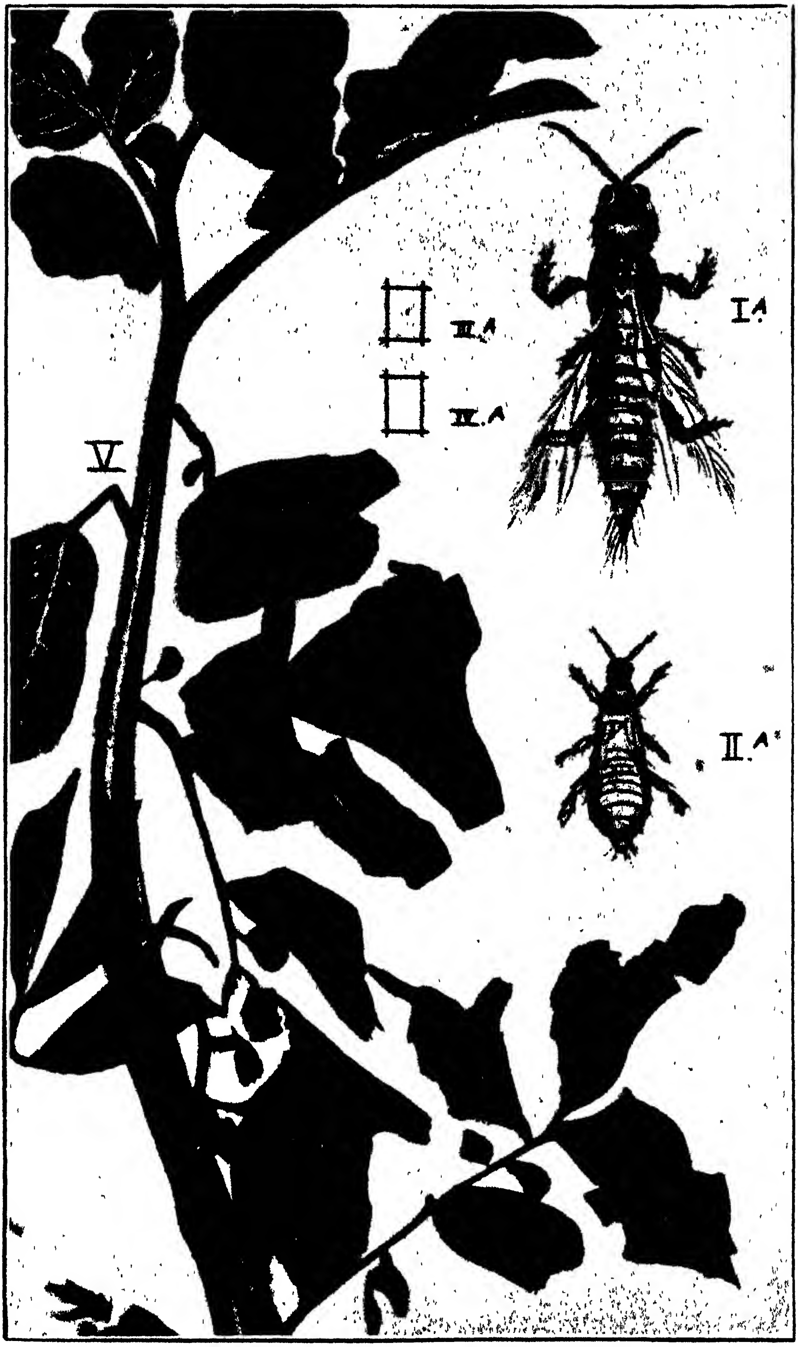


Plate I.—Potato Thrip (thrips tabaci Lindemann).

EXPLANATION OF PLATE.

Fig.
IA Female. Perfect insect. Magnified.
IIA. Perfect insect. Magnified.
IIIA. Perfect insect Natural size.

Fig.
IVA. Larva. Natural size.
V. Potato stem, with foliage dying. Natural size.

Cut Worms and Looper Caterpillars.

These include a number of different but closely allied species variously known as Cut Worm Caterpillars, Looper Caterpillars, Army Worms, Take-all Grubs, &c.

Plate No. 2 shows some of the common cut worm moths, also two other species of closely allied Noctuids (night moths). In the Museum of Economic Entomology and Ornithology of this Department are specimens of all the Victorian Cut-worm moths, their eggs, and larvæ. The collection may be inspected by all interested.

Of those shown in the plates, the Silvery Moth (*Plusia argentifera*) is at times destructive to potato crops in many parts of Victoria. Complaints from growers have also been received regarding the *Agrotis* (several species), Potato Looper Moth (*Plusia verticillata*), *Heliothis armigera, Leucania* sp., and others. The cut worms are the larvæ of these insects, and every year they are the cause of much destruction on farms, vineyards, and gardens. Wheat, oats, barley, maize, vines, plums, tomatoes, onions, beans, cabbages, and potatoes are all subject to attack.

Life History.

Closely allied as they are in their habits of life, differences between individual members of this group are chiefly morphological. There are at least two broods of cut worms in a season, but further observations will be necessary before the number is finally ascertained. The moths usually fly about at dusk, and deposit their eggs on any suitable plant. The eggs hatch in a few days, and the young cut worms begin to feed at once, any kind of green food being greedily eaten by them.

The cut worms vary in colour according to the species. Those of the Tomato Moth vary from green to yellowish, but most of the *Agrotis* are of a dirty greyish or light-brown colour, without hairs or spines, smooth, and greasy looking, often being of a similar colour to the ground in which they hibernate. Some of the cut worms feed both day and night; others rest during the day just under the soil, or under logs, stones, bark, bags, and rubbish, and feed only during night.

They are fully grown in a couple of weeks, and are then ready to pupate. The pupa is of a dirty reddish-brown colour, sometimes almost black. After pupating, they remain in the ground, from ten to fifteen days during warm weather, before the moths emerge; in cold weather the period is much longer.

Remedies.

By the eradication of weeds and the burning of haulms and stems of harvested crops the cut worm evil may be greatly minimized, as by this means many eggs are destroyed.

Growing crops may be treated in the following manner:—Place between rows of an infested crop or at short distances apart, bundles of any succulent weed or vegetable which has been previously poisoned by dipping it into a strong mixture of Paris green, 1 oz. to a bucket of water. The cut worms eat the poisoned plants, bury themselves and die. In hot dry weather the bundles should be put out after sundown. Correspondents have frequently inquired whether there is any likelihood of vegetables absorbing Paris green from bundles when

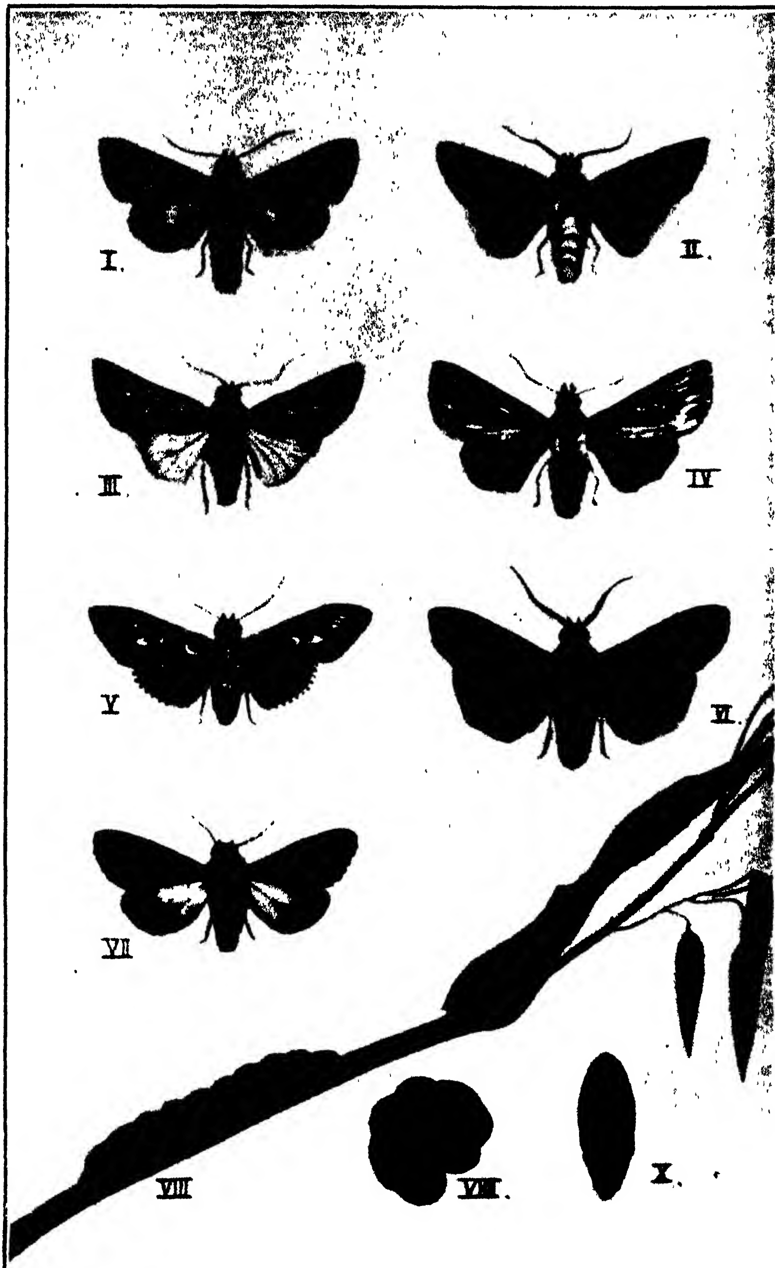


Plate II.—Cut Worm Moths.

EXPLANATION OF PLATE.

Fig.
I. *Chloridea obsoleta.* (Tomato Moth.)
II. *Cirphis unipuncta.*
III. *Euxoa radians.*
IV. *Persectania ewingi.* (Climbing Cut Worm.)
V. *Plusia argentifera.* (Silvery Moth.)

Fig.
VI. *Agrotis spina.* * (Bugong Moth.)
VII. *Euplexia nigerrima.*
VIII. Larva of *Agrotis.*
IX. Larva curled up.
X. Pupa of *Agrotis.*

(Natural size.)

placed near the roots. I am assured by the Chemist for Agriculture that there is no danger, as Paris green is practically insoluble, and therefore cannot be absorbed by plants.

The poisoned bran mash has also been successfully tried, especially against the Silvery Moth, the larvæ of which are so destructive to potato crops. In preparing the mash use one part, by weight, of arsenic, one of sugar, and six of bran, add sufficient water to make a wet mash. The mixture is usually made in a wash tub or half barrel. This is filled three-fourths full with dry bran, and there is added about 5 lbs. of arsenic, which is thoroughly stirred through the bran with a spade or shovel; 5 lbs. of sugar are next placed into a pail, water is added, and the sugar stirred until it is dissolved. The sugar water is then added to the bran and arsenic, and the whole well stirred. More water is added, and the stirring continued until every portion of the mash becomes thoroughly saturated. The mixture should be placed around and through the crop, or at the foot of the tree, plant, or shrub infested, dropping it in the shade when this can be done. Both of these preparations should be kept out of the way of children and domestic animals.

With regard to the efficacy of the poisoned bran mash, I have recently received the following letter from Mr. G. Ray, of Lindenow, Gippsland:—

The cut worms were very prevalent this season, but I have had great success in destroying them. I had a crop of English barley, and, thanks to the use of the bran mash, I have just thrashed from 40 to 70 bushels per acre. The caterpillars were two or more inches deep in shady places, and I am sure that I would not have had any returns unless precautions had been taken.

Mr. C. W. Malley, Eastern Province Entomologist in South Africa, reports excellent results with poisoned baits. He says:—

It occurred to me that by cutting up all available green stuff (lucerne, barley, forage, rape, young succulent weeds, &c.) into small bits, say half-an-inch in length, it could be moistened with the poisoned sweet and then scattered broadcast over the lands with least labour and material. In this way it is distributed evenly, and at such frequent intervals, that the cut worms are practically certain to find it before they do the plants. Their fondness for sweets induces them to fully engorge themselves with the bait, a fact which makes their destruction certain. There is also no danger to stock, for the pieces of bait are so small that nothing but poultry can pick them up, and it is not likely that even they will get enough to injure them. But, as a precaution, they should be kept from the lands where bait has been spread.

During the past six months several additional experimental tests have been made with cut worms, and with satisfactory results. I see no special difficulty in the way of applying the following remedy on a large scale to lands planted with tobacco, maize, or other crops, and therefore call attention to it for the benefit of any who may have occasion to use it:—

Method of Preparation.

Arsenate of soda	1 lb.
Treacle or brown sugar	8 lbs.
Water	10 gals.

Dissolve the arsenate of soda and the treacle in the water. In the meantime cut up lucerne, or other green stuff into small bits, and then moisten it with the poisoned sweet. Be careful not to make it too wet, or it will not scatter well when broadcasting. For the best results, the bait should be distributed a few days after the ground has been

ploughed, and all green succulent vegetation destroyed. The cut worms that are not injured in ploughing will then be on the surface again, and on account of their long fast, practically all of them will be prowling about in search of food. In this way, one application will probably be sufficient. If injury is noticed after the young maize plants appear, the application should be repeated.

Where a spray is employed in place of poisoned bait, arsenate of lead has proved one of the best. By using this spray, growers in the Frankston and Cheltenham districts have saved their potato crops from the ravages of the Silvery Moth. Where cut worms are feeding in grass paddocks adjoining crops, it is advisable to spray a strip of the crop. After devouring the grass they move on to the crop, and, when they come to the sprayed portion, devour it greedily, and are soon

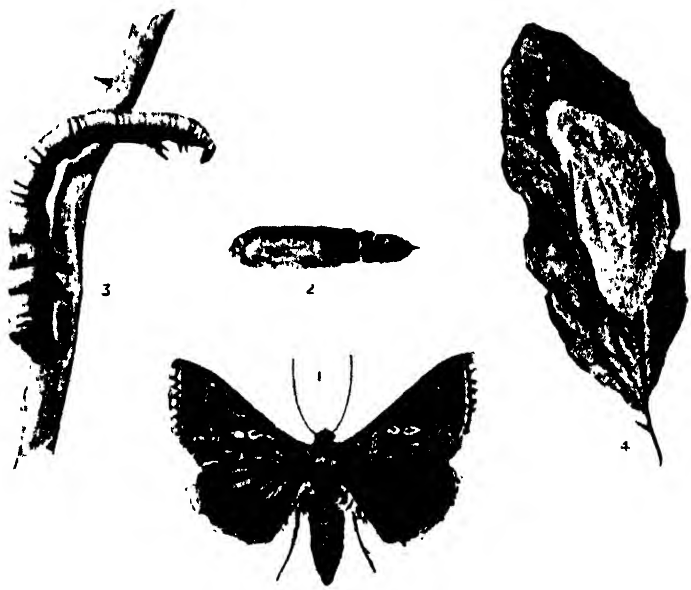


Plate III.—Potato Looper Moth (*plusia verticillata*) **(after W. W. Froggatt).**

1. Adult Moth. 2. Pupa. 3. Larva. 4. Cocoon.

destroyed. If vegetables are sprayed it is advisable to thoroughly wash them before using.

The trench system is a simple and effective method of eradication. A trench or furrow should be either ploughed or dug around the crop towards which the cut worms are feeding. It must have clear cut sides; those nearest the crop should be undercut so as to prevent the cut worms from crawling out of the trench. Deep holes should be made in the trench at intervals of, say, 5 yards. When travelling towards the crop the cut worms fall into and crawl along the trench and ultimately into the holes. A few shovelfuls of earth, well rammed, will then speedily destroy them. Should the pest be already in the crop, it may be useful to run a few furrows through it to prevent it spreading.

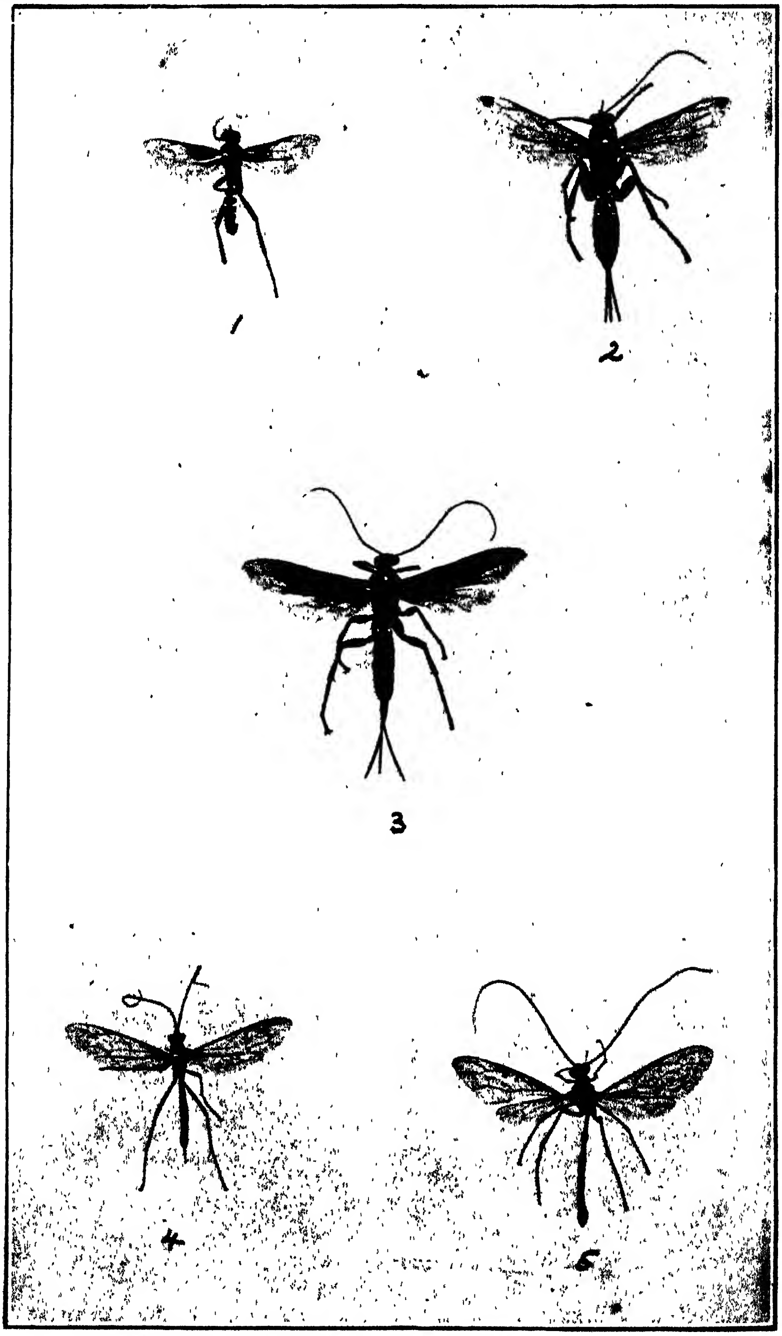


Plate IV.—Ichneumons.. (Dark winged Ichneumon.)

Beneficial Insects. Destroyers of Potato Insect Pests.

EXPLANATION OF PLATE.

Fig.
I. and II. *Rhyssa semipunctata*, Male and Female.
III. *Pimpla intricatoria.* (Spotted black Ichneumon.)

Fig.
IV. *Ophion sp.*
V. *Ophion sp.*

Another plan that answers well is to place a flock of sheep in the infested paddock adjoining the grass crop. The constant walking about of the sheep will destroy many cut worms.

If cut worms are prevalent in gardens, rake the ground up close to the plants. By this means many of them are turned up, and if poultry are allowed to run over the ground very few will escape their notice. They are also easily injured by the rake, and are then likely to be eaten by ants and insectivorous birds when exposed on the surface of the ground.

Numbers of cut worms are destroyed by hymenopterous and other parasites. Very wet and cold weather also keeps them in check.

POTATO MOTH.

(*Lita solanella,* Boisd.)

According to various writers this destructive pest of the potato crop has been known in Australia since 1854, and has spread to all the States, It has caused considerable losses to growers, and is certainly the worst potato pest in the Commonwealth.

Potato moths are usually more plentiful after a mild warm winter. There are two broods of moths. The first, the winter brood, may destroy the young plants and thereby ruin the crop. The moths of the second brood deposit their eggs on the potatoes themselves when the tubers are stored or are in the field. Occasionally, especially if potatoes are grown in stiff soil, the moths will crawl down the cracks in the ground and deposit their eggs on the tubers. The eggs are usually from 20 to 30 in number, and hatch in from six to ten days. In sandy soil tubers are rarely so attacked. The young grubs, when hatched, usually feed upon the eyes of the potatoes; they then tunnel towards the centre of the tubers, causing them to become brownish-black, and inducing decay. Sometimes when the potato plants are fully grown the female moth deposits her eggs on the leaves. The young grubs feed on these, and afterwards gnaw their way down the main stalks, reaching the tubers below. Fortunately for growers the chrysalids of the potato moth are attacked by parasites, bacterial diseases, and climatic influences, which destroy great numbers.

Life History.

Eggs.—Very minute, of a white colour and glistening.

Caterpillar.—When fully grown it measures about ½ inch long, and is of a faint pinkish colour, with a brown head. It usually pupates under the skin of the potato, and is surrounded or protected by dirt, excrement, &c.

Chrysalid.—The pupa or chrysalid is dark-brown in colour, and is enclosed in a silken bag or cocoon.

Moth.—The moth is small, of a light brownish-grey colour, the size being:—body, about ¼ inch in length; front wings, which are darker than the hind ones, female, about ½ inch across when expanded, male slightly smaller. The wings of both sexes are feathery or fringy, but this is not so pronounced in the male as in the female.

Prevention and Remedies.

Dead potato plants, discarded and small potatoes, and rubbish should be gathered and burnt. Old sacks and cases in which there

have been infected potatoes should be dipped into boiling water. By this means any grubs and chrysalids secreted in them will be destroyed.

Seed infested with the grubs should never be planted, nor should ground where moth-affected potatoes were grown the previous year be used again for potatoes. Plant the seed deep, and keep it well covered. The ground should be pressed firmly down, and it would be advisable to till it a second time. Never leave potatoes exposed in the field. When they are dug up they should be at once bagged and removed to the storeroom, where they must be placed in bins, pits, or any other receptacles where moths cannot get at them to lay their eggs in the eyes of the tubers. It is a common practice with many growers to simply heap the potatoes up in the storeroom without any covering, and to leave the doors wide open. It is no wonder that considerable losses occur.

Trapping by means of lamps is of use in destroying the moths, which fly about at night. Procure an ordinary tin basin, and in this place a brick and enough kerosene to reach half-way up the brick, and on the brick a lighted lamp. The moths are attracted to the light, and, flying against the lamp, fall into the kerosene, which kills them. The basin could be placed on an ordinary box, such as a kerosene case. Several of these lamps could be placed in a field of potatoes at night time.

When the moths commence to make their appearance, it is advisable to spray the crop with some arsenical spray, such as arsenate of lead. This will destroy the young grubs as soon as they commence to feed. A good arsenical spray is prepared as follows:—Boil 1 lb. of white arsenic and 2 lbs. carbonate of soda (crystals) in ½ gallon of water for twenty minutes. Separately dissolve 7 lbs. of arsenate of lead in 1 gallon of warm water. When both mixtures are cold mix them together. Bottle into twelve 1-pint bottles, and use one bottle to 30 gallons of water. Mix the chemicals in wooden buckets.

As many reliable brands of arsenate of lead are now on the market, and at a fairly cheap rate, the majority of growers may prefer to purchase the ready-made article instead of going to the trouble of mixing this excellent spray mixture themselves.

In cases where spraying is expected spaces might be left between every few rows of potatoes for the horse drawing the spray pump to pass, otherwise many of the plants will be trampled down. During a recent spraying demonstration on potatoes, this oversight on the part of the growers was very noticeable. At the present time some excellent motor, automatic, and other spray pumps, specially designed for potato spraying, are on the market, the nozzles being made so that the whole plant may be thoroughly sprayed. Six or more rows of potatoes can be sprayed at the same time. Recent experiments by the writer and other officers of the Department proved the value of these pumps, which are now coming into general use.

As the potato moth is proclaimed an insect pest under the Vegetation Diseases Act, it would be advisable that the potato inspectors should inspect all storerooms in the country districts where potatoes are grown, and see that every precaution is taken by growers to protect the tubers from the ravages of this moth. One careless grower in a district can breed enough moths to ruin all his neighbours' crops, and it is against such a grower that action should be taken.

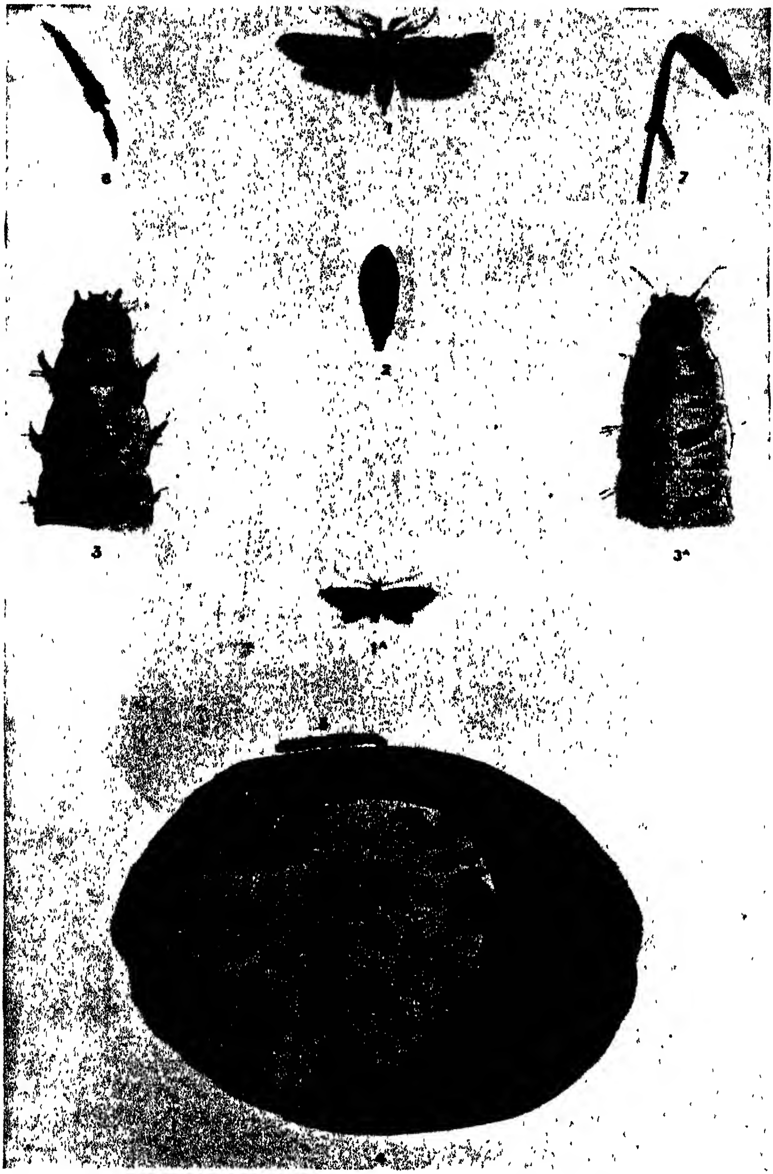


Plate V.—Potato Moth. (*Lita solanella, Boisd.*)

EXPLANATION OF PLATE.

Fig.
I. Moth. Magnified.
IA. Moth. Natural size.
II. Pupa. Magnified.
III. Head and first three segments of larva. Upper side. Magnified.
IIIA. Head and first three segments of larva. Under side. Magnified.

Fig.
IV. Potato sliced to show effect of attack by larvæ of moth. Natural size.
V. Larva. Natural size.
VI. Fore leg. Moth.
VII. Hind leg. Moth.

POTATO AND TOMATO WEEVIL.

(*Desiantha nociva*, Lea.)

This is a comparatively new pest of the potato, and was first reported in December, 1908, from the Essendon district. Here it caused young potato and tomato plants to fall to the ground by eating the stems through at the base. It has now been found in many parts of Victoria, extending right into the Wimmera district. Like many other native insects it has forsaken its natural food, probably some of the native Solanums, and taken to potatoes and tomatoes. Various vegetables and garden plants are also attacked by it.

The larva is of a light pea-green colour, and measures about a quarter of an inch in length. In the daytime it is usually found in the soil a few inches below the surface. When about to pupate it constructs a cocoon made of soil, where it remains for a couple of months until it emerges as the perfect beetle.

The beetle, which measures about a quarter of an inch in length, varies in colour from light-grey to dark-brown. Some specimens have a V-shaped mark on the wing cases, and two projections, one on each side of the wing cases. It is quite as destructive as the larva, and, like it, goes down into the soil in the daytime, and comes up to feed at night. The larvæ often feed in the daytime as well as at night, but the perfect insects rarely do so. It is a prolific breeder, and every possible means should be adopted to prevent its spread. It may be seen at all times throughout the year, and the damage done is considerable.

Prevention and Remedies.

All weeds, especially marshmallows, on land adjoining potato crops should be destroyed. This insect will eat almost any kind of weed, so it is necessary that these precautions be taken. Fortunately, in the arsenate of lead spray we have an excellent remedy for this pest. Experiments carried out by this Branch prove that by this means it can be kept in check.

JASSIDS, LEAFHOPPERS OR FROGHOPPERS.

These are small greenish-yellow insects, not unlike miniature cicadas, and about the size of the aphides on roses. They are very active, and can be seen in thousands on the leaves of all kinds of plants, now and again doing damage to the young shoots and foliage. Large numbers are often seen on potato plants.

These insects do not seem to cause any noticeable damage, but, as they appear to be on the increase, it would be as well for growers to keep a strict watch for them. If found causing any damage it would be necessary to spray the crop with Benzole emulsion, 1 to 5 gallons of water.

THE RUTHERGLEN BUG.

(*Nysius vinitor.*)

This is one of the many plant bugs found in Victoria, and it is probably the most destructive. The perfect insects measure about 1½ lines in length, the general colour being greyish to light brown; the wings,

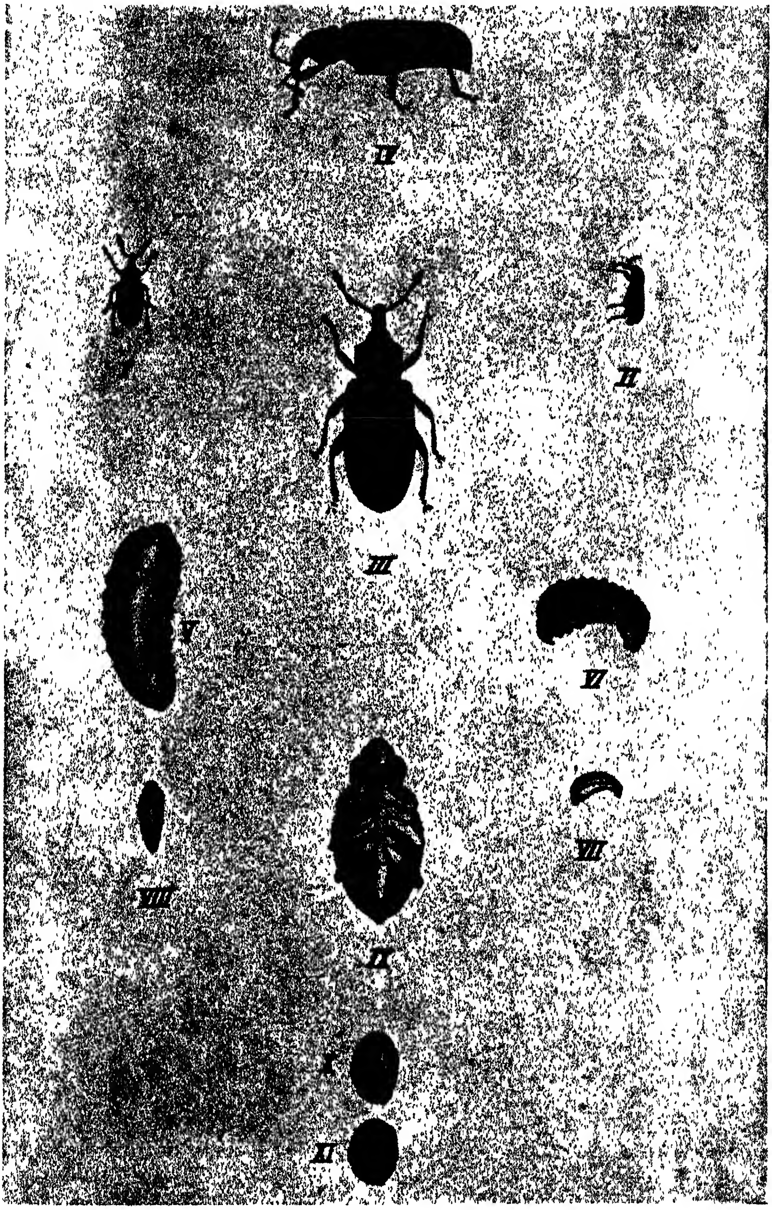


Plate VI.—Potato and Tomato Weevil. (*Desiantha nociva, Lea.*)

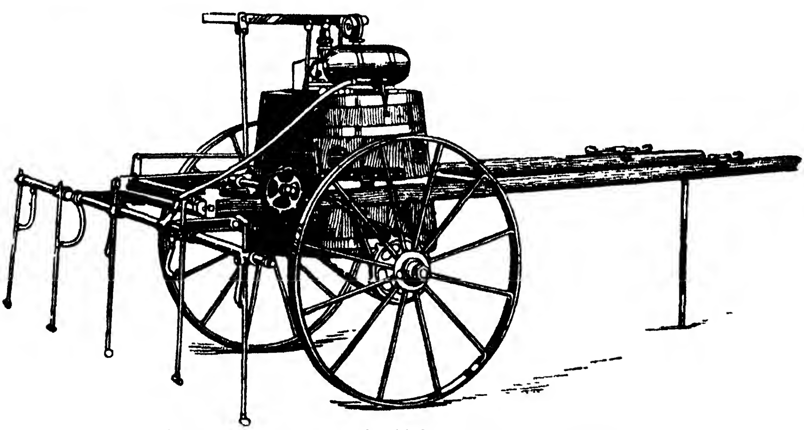
EXPLANATION OF PLATE.

Fig.
I. Perfect insect. Natural size.
II. Perfect insect. Natural size. Side view.
III. Perfect insect. Enlarged
IV. Perfect insect. Enlarged. Side view.
V. Larva. Enlarged.
VI Larva. Enlarged. Side view

Fig.
VII. Larva. Natural size. Side view.
VIII. Larva. Natural size. Side view.
IX. Pupa. Enlarged.
X. Pupa in cocoon. Natural size.
XI. Cocoon. Natural size.

with the exception of a few dark line-like markings when closed, are transparent. It is a very active insect, and has a habit of dropping or flying to the ground when plants, fruits, &c., on which it is resting are touched. The bug is furnished with a rostrum or beak, with which it sucks the sap from the plants, and causes them to wither and die. In the summer it is seen actually in thousands on potato and other crops, garden plants, &c., thereby causing growers considerable loss.

The "Fleming" Automatic Potato Sprayer.



Improved Automatic "Doncaster" Sprayer.

Plate VII.—Type of Spray Pumps in general use for spraying potato crops.

Some years ago, the first specimens of this insect were sent in from Rutherglen, hence the name Rutherglen bug. At that time, the insects were doing much damage to vegetables, tomatoes, potatoes, and to all kinds of fruit. Various experiments were carried out by Mr. C. French, senior, for the suppression of the pest, and good results were obtained by using the Benzole emulsion spray. At that time no motor spray pumps were available, and spraying the potato crops with hand pumps was a tedious proceeding.

Prevention and Remedies.

See treatment recommended for thrips.

Plate VIII.—Rutherglen Bug. (*Nysius vinitor.*)

EXPLANATION OF PLATE.

Fig.
I. Branch of cherry tree, with fruit and insects. Natural size.
II. Perfect insect. Under view. Magnified.

Fig.
III. Perfect Insect. Upper view. Magnified
IV. Head of adult insect. Magnified.
V. Perfect insect. Natural size.

WIRE WORMS.

There are a considerable number of species of wire worms found in Victoria. They belong to the family of *Elateridæ*. The mature insects are known as Skip Jack, Click, or Flip Beetles, from their peculiar habit of springing into the air with a click, should they fall on their back.

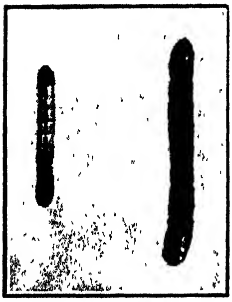


Plate IX.—Wire Worms.
(Natural Size.)

The wire worm, which is of a dark-brown shining colour, varies from $\frac{1}{4}$ to nearly 1 inch in length, being usually about as thick as a match. The body is cylindrical, rather flat, compressed at the head and pointed behind; each of the first, second, and third segments of the thorax carries a pair of short legs. Wire worms have powerful mandibles or jaws, which are well adapted for biting roots. The insects vary in length from $\frac{1}{2}$ to $1\frac{1}{4}$ inches, the colour being generally dark brown or approaching light black.

Fortunately for growers in Victoria this pest does not appear to make much headway, no doubt owing to its natural enemies. A bad outbreak occurred some years ago in the Ballarat district, and caused growers much concern, but the trouble has not recurred. The accompanying photographs show how the larvæ of these beetles destroy the potatoes.

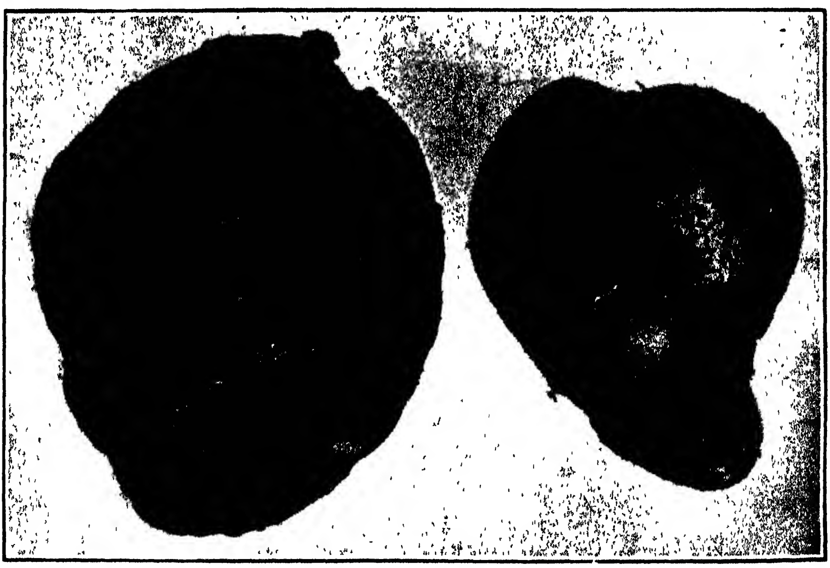


Plate X.—Potatoes damaged by Wire Worms.

Prevention and Remedies.

One of the best methods of keeping wire worms under control is to cultivate the ground frequently and thoroughly, turning it over and exposing the insects so that insectivorous birds can clear them off.

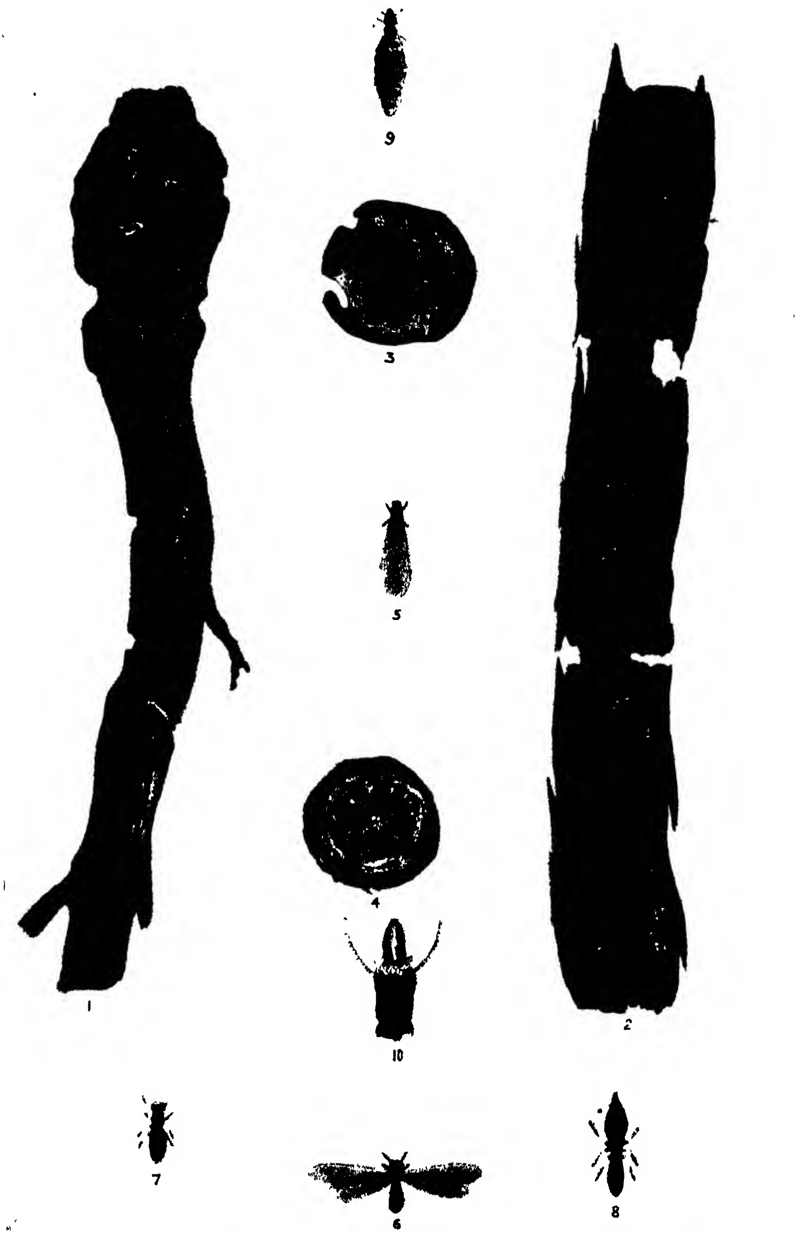


Plate XI.—Victorian White Ant. (Termes lactis, Froggatt.)

EXPLANATION OF PLATE.

Fig.
I. Portion of orange root attacked by white ants, showing insects at work and damage done. Natural size.
II. Portion of vine stem attacked by white ants, showing insects at work and damage done. Natural size.
III. Transverse section of orange root destroyed by white ants. Natural size.

Fig.
IV. Transverse section of vine root showing damage done by white ants. Natural size.
V. Male, with wings folded. Natural size.
VI. Male, with wings extended. Natural size.
VII. Worker. Natural size.
VIII. Soldier. Natural size.
IX. Queen. Natural size.
X. Head of "Soldier White Ant," showing the powerful jaws. Magnified.

Frequent harrowing will also keep them down, as by this means the wire worms are injured, and never reach the beetle stage. Poisoned baits are sometimes used with good results. These are made by cutting a few turnips, carrots, or potatoes into small pieces, soaking them in arsenate of lead, and then putting them into the soil.

Vaporite is a useful remedy. (For treatment and quantity to use, see under Victorian White Ant.)

Manurial Insecticide worked into the soil has given good results.

THE VICTORIAN WHITE ANT.

(*Termes lactis,* Froggatt.)

The so-called White Ant, which has no affinity to the true ant, is exceptionally common in many parts of this State, and its depredations are unfortunately well known. It is a destroyer of timber and furniture, as well as apricot, plum, and other fruit trees, vines, potatoes,

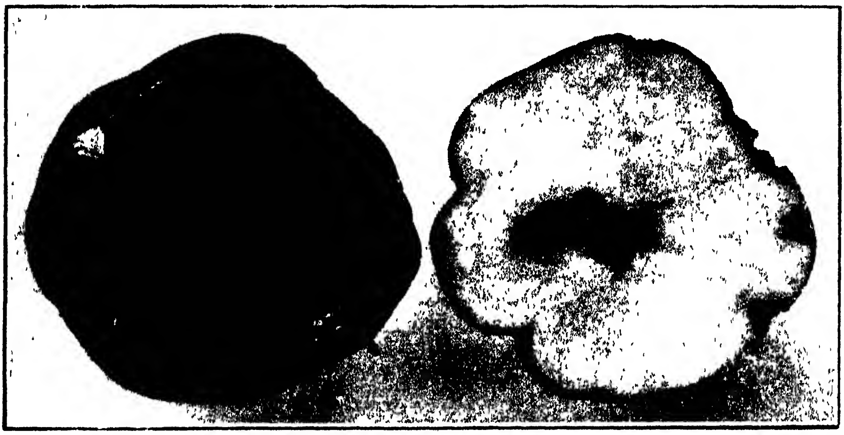


Plate XII.—Potatoes showing damage caused by White Ants.

&c. When a fruit tree is badly attacked by white ants the bark tends to change colour, and assume a sickly appearance.

Fortunately for potato growers this pest does not seem to make much headway, but at the same time it should be watched, for when once our native insects leave their natural food there is no telling what damage they may do. The white ants are small and of a yellowish-white colour, and in general appearance, not unlike tree ants. They inhabit structures known as termitaria, which are mounds or hillocks, in old roots of eucalypts and other trees. The plate gives a good idea of the various phases of the white ant and its workings.

Prevention and Remedies.

When it is intended to form a potato field, the first thing to be done is to have all old stumps and roots of trees removed and burnt. I have seen in many fields numbers of old stumps and roots of trees left, and on examination found them to be full of white ants in all stages. Where they are allowed to harbour they are liable to attack potatoes, so the necessity of destroying their breeding places is obvious. A careful grower has very little to fear from the attacks of white ants if this precaution is taken.

When taking out old stumps many white ants are likely to fall into the holes caused by their removal, and in such cases it is advisable to pour a cupful of bisulphide of carbon into each hole; cover it immediately, and stamp the soil well down. The fumes of the poison will destroy the ants. When using this chemical great care must be taken that no lights are placed near it as it is highly inflammable.

Another plan is to dig Vaporite into the soil, which is then pressed firmly down. The quantity to be used varies with the character of the soil; light soils require a lesser amount than heavy ones. The lighter the soil the more easily is the mixing effected, and the more easily will the gas penetrate. The quantity of Vaporite used is generally at the rate of 225 lbs. per acre for light soils, and about 350 lbs. for heavy soils, but for filling holes these quantities would be exceeded.

Manurial Insecticide worked into the soil has given good results.

MILLEPEDES.

Millepedes are closely allied to insects, but belong to another class (*Myriapoda*, which includes centipedes). The body is crustaceous, the

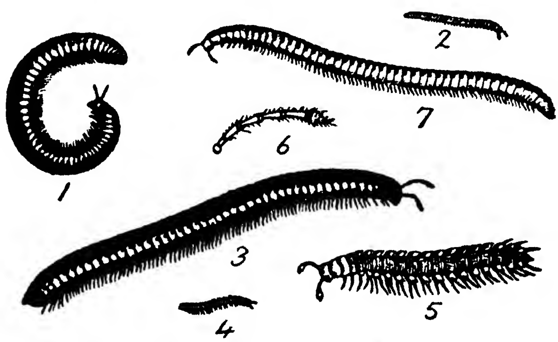


Plate XIII.—Millepedes.

EXPLANATION OF PLATE.

Fig.
1. Millepede. Magnified
2. Natural size of No. 7.
3. Millepede. Magnified.
4. Natural size of No. 5

Fig
5. Millepede. Magnified.
6. Antenna or horn of Millepede. Magnified.
7. Millepede. Magnified (after Ormerod).

antennæ or feelers seven-jointed, and the first segment of the body has the form of a little shield. The feet are numerous.

The eggs are laid in the ground amongst vegetation, &c. The young *Julidæ* (Millepedes) live two years before they are perfect, during which time they grow and change their skin five times. They maintain the same appearance throughout, excepting for an increase in the number of legs.

Millepedes are both herbivorous and carnivorous in their habits. At times they attack young potato plants when just sprouting under the soil, and on that account are mentioned here. In some localities in this State they do a certain amount of damage to other crops as well as potatoes.

Manurial Insecticide worked into the soil has given good results.

Prevention and Remedies.

One of the best remedies is to thoroughly cultivate the land. Remove and destroy all rubbish under which they could shelter. When they are in the ground Vaporite has given good results. The Vaporite should be well incorporated with the soil to a sufficient depth when the ground is cultivated. (See further particulars as to quantity to use under Victorian White Ant.)

Mr. W. E. Collinge, M.Sc., Birmingham, in his *First Report on Economic Biology,* states that the following remedy has proved very successful. In flower beds, dig out a hole sufficiently large to contain the fist and wrist; fill with bran, and cover with water. After two or three days pour on to the bran boiling water. The contents of two such holes were examined after treatment, and were found to contain 2,448 and 1,793 dead millepedes respectively.

WOOD LICE, SLATERS, OR SOW BUGS.

This pest is destructive to potatoes, both in the field and when stored in pits. Wood lice are not, strictly speaking, insects, but as they cause considerable damage they are included in this article on potato insect pests.

Wood Lice belong to the *Crustaceae,* a prime division of *Arthropods,* which includes lobsters, crabs, shrimps, prawns, &c. The common wood louse is mostly nocturnal in its habits, retiring during the day under stones, *debris,* old bags, bark, and, in fact, almost any kind of hiding place that is accessible, and coming forth in the evening to feed. It has a peculiar habit of contracting itself into a ball when disturbed. The eggs are very small, shining, and pale yelow-white in colour; they hatch rapidly under suitable conditions.

Prevention and Remedies.

Do not allow any *debris,* old bags, logs, &c., to lie about on fields where it is intended to plant potatoes, as the animals may lodge there.

Traps.—Cook in a solution of arsenic a piece of parsnip, beetroot, or potato, and place it in the haunts of the wood lice. They will eat this greedily.

Mr. A. M. Lea says—

> They can be trapped in large numbers by placing empty boxes (or bones on top of old sacks) at the side of the garden. and into these the wood lice will creep on the approach of day.

Should the wood lice be in the ground it would be advisable to treat the soil with Vaporite before sowing. Recent experiments conducted by the writer with this material proved very satisfactory. The Vaporite was well worked into the soil amongst the wood lice, and after a few days an examination of the ground showed the wood lice to be quite black, the gas from the Vaporite having destroyed them.

LAMINITIS OR FOUNDER.

By R. N. Johnstone, B.V.Sc.

[In an article which appeared in the *Journal of Agriculture*, Victoria, for February, 1913, "Wheat Gorge in Horses" was dealt with. As Laminitis often follows an overfeed of grain, this article is now published as a continuation.—Editor.]

Laminitis arises from a variety of causes, among them an overfeed of grain such as wheat, barley, maize, rye or new oats. New grains give rise to this trouble more frequently than grain which has been stored. Laminitis may also arise from overwork, or from standing for long periods—as on a ship voyage—and we get it as a sequel to difficult parturition, to pneumonia and other inflammatory diseases. The outer portion of the foot of the horse is composed of a horny box—the hoof. The inner surface of the hoof carries a number of leaf-like projections which project inwards and upwards, and are known as horny laminæ. Fitting into the projections between the horny laminæ are the sensitive laminæ, which serve to join the hoof to the bony portion of the foot and to carry the weight of the body. These laminæ, which are longer and stronger in front, carry blood vessels and nerves, and are very sensitive, corresponding somewhat to the quick of the human nail. Laminitis is an inflammation of the sensitive laminæ, and the consequent swelling causes pressure and pain.

The first symptoms of laminitis are those of fever, the temperature goes up several degrees, breathing is short and hurried, the mucous membranes of the eyes and nostrils are red, the mouth is dry and hot, and the urine scanty. As yet the walk is sound; but while standing the horse will lift first one foot and then the other, replacing them on the ground almost immediately. This paddling movement is kept up almost continuously. Within a few hours the pain in the affected feet becomes greater, and it is with difficulty that the horse can be induced to move. When the animal is compelled to move, the feet are shuffled forward in a cautious manner, and the weight is thrown on the heels. The affected feet feel hot to the touch, percussion with a hammer gives rise to great pain; and any attempt made to lift a foot is useless, the pain being so great that the animal is unable to bear extra weight on the opposite foot. When all four feet are affected, the animal puts the fore feet out in front of him, and the hind feet are put underneath the body as far as possible, the object being to throw most of the weight on the heels, where the pain is not so great. When the front feet alone are affected, the animal stands in the position just described, and throws as much weight as he can on the hind feet. When the hind feet only are affected, the animal gets all four feet as close together under his body as he can, the weight as far as possible is thrown on the front feet, while the hind feet are carried forward and placed on the heels. As might be expected, the pain is not so great when the animal is lying down. Strange to say, however, in most cases the animal persists in standing, but once down it is difficult to persuade it to rise again. Mild cases of laminitis if carefully treated recover in three or four days, the

fever subsides, the appetite returns, and the walk becomes easier. Cases recovering so soon as this do not seriously alter the shape of the foot. When recovery is delayed longer than this, although the animal may become perfectly sound, the wall of the hoof will always show rings, and the sole will be slightly flattened. In more serious cases, the sensitive and horny laminæ separate—particularly at the toe—and the whole weight is thrown on the sole, causing dropped sole and permanent lameness. Occasionally the pedal or coffin bone penetrates the sole and comes in direct contact with the ground. If treatment should be commenced in the early stages, before acute lameness is shown, remove the shoes from the affected feet, cut or rasp the walls down until the foot is bare. The object in doing this is to bring the sole as near the ground as possible, so that when the animal is walking or standing the ground will support the sole, which will take more than its usual amount of weight and thus relieve the strain from the wall and the sensitive laminæ attached to it. When lameness is acute, it will be almost impossible to do this while the horse is standing, owing to the animal being unwilling or unable to stand on three feet. The sole should not be pared or thinned in any way; it requires all its strength to carry the extra weight which will be thrown on it. Bleeding from the toe or coronet should not be allowed, because wounds in these localities are extremely difficult to keep clean, and so are liable to become septic and cause serious complications; and the amount of horn cut away when bleeding at the toe is attempted weakens the sole more than is advisable. Bleeding from the jugular vein is allowable, but never more than a gallon of blood should be removed. Cold water should be applied to the feet. When a suitable water course, pond, or other expanse of shallow water is at hand, the animal should be kept standing in it; or, if possible, walked about in it. When suitable apparatus is available, a constant stream of cold water over each foot from a rubber hose is beneficial. If lameness is not severe, the animal should have walking exercise from half-an-hour to an hour and a half three times a day on soft ground. While it may be difficult to get the animal to move at the start, the action will improve with exercise. Between times a cold foot bath should be given.

In the early stages of the trouble, while fever is a prominent symptom, give Tincture of Aconite, ½ drachm, three times daily. Many animals will take this in their drinking water. Nitrate of Potash, ½ drachm, and Epsom Salts, 2 ounces, may also be given in the drinking water. Complications to be looked for are pneumonia and suppuration in the affected feet. In the latter case, the pus which develops in the foot should be liberated. The necessary operation and subsequent treatment should be carried out by an experienced veterinarian.

Good nursing is very necessary in these cases. During the first stages of the disease, a light and easily digested diet should be allowed—bran mashes, roots and green food when available—the water supply should be ample, the body should be warmly clothed, and if treated in a box the animal should get plenty of fresh air. A good supply of bedding should be given, but long straw should be avoided, as it rolls up in front of the animal and prevents free movement. Chaff, tan or sand is much more satisfactory in these cases.

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

PART X.—PACKING—*continued.*

(*Continued from page* 705.)

By E. Meeking, Senior Fruit Inspector.

A Plea for the Introduction of the Diagonal-numerical System of Packing Apples—*continued.*

Packing in the Australian Case.

The Australian export so-called "dump" case may be utilized for diagonal numerical packing of apples, and the list of packs shown hereunder have been worked out by Mr. C. D. Samson, who has kindly submitted them to the officers of the Department. They have been tested and found quite applicable. The Australian case is suitable for packing the larger sized apples. Concerning the smaller sized apples, the American case is much better suited for packing these than the Australian case, and in most other respects it lends itself for general purposes of packing to greater advantage than the Australian case, as will be shown hereunder in the summarized comparison of the two cases.

Schedule of Different "Packs" Adopted for Packing Apples in the Australian Export Case under the Numerical System.

2 × 1 "*Packs,*" 2½ *tier* . . 5 *tiers to case.*

Approx. Diameter of Apple.		Apples to Case.	
3⅞ inches	3 × 3 = 2 rows of 3 + 1 row of 3 = 6 + 3 = 9 × 5 =	45	
3¾ ,,	. 4 × 3 = 2 . 4 + 1 ,, 3 = 8 + 3 = 11 × 5 =	53	(*)
3⅝ ,,	4 × 4 = 2 ,, 4 + 1 ,, 4 = 8 + 4 = 12 × 5 =	60	
3⅝ ,,	. 5 × 4 = 2 ,, 5 + 1 ,, 4 = 10 + 4 = 14 × 5 =	68	(*)
3½ ,,	.. 5 × 5 = 2 ,, 5 + 1 ,, 5 = 10 + 5 = 15 × 5 =	75	
3⅜ ,,	. 6 × 5 = 2 ,, 6 + 1 ,, 5 = 12 + 5 = 17 × 5 =	83	(*)
3¼ ,,	.. 6 × 6 = 2 ,, 6 + 1 ,, 6 = 12 + 6 = 18 × 5 =	90	
3⅛ ,,	.. 7 × 6 = 2 ,, 7 + 1 ,, 6 = 14 + 6 = 20 × 5 =	98	(*)
3 ,,	.. 7 × 7 = 2 . 7 + 1 ,, 7 = 14 + 7 = 21 × 5 =	105	

2 × 2 "*Packs,*" 3½ *tier* . .. . . . 6 *tiers to case.*

3⅛ inches	.. 4 × 7 = 2 rows of 4 + 2 rows of 4 = 8 + 8 = 16 × 6 =	96	
3 ,,	.. 5 × 4 = 2 ,, 5 + 2 ,, 4 = 10 + 8 = 18 × 6 =	108	
2⅞ ,,	.. 5 × 5 = 2 ,, 5 + 2 ,, 5 = 10 + 10 = 20 × 6 =	120	
2¾ ,,	.. 6 × 5 = 2 ,, 6 + 2 ,, 5 = 12 + 10 = 27 × 6 =	132	
2⅝ ,,	. 6 × 6 = 2 ,, 6 + 2 ,, 6 = 12 + 12 = 24 × 6 =	144	
2⅝ ,,	.. 7 × 6 = 2 ,, 7 + 2 ,, 6 = 14 + 12 = 26 × 6 =	156	
2½ ,,	.. 7 × 7 = 2 ,, 7 + 2 ,, 7 = 14 + 14 = 28 × 6 =	168	
2⅜ ,,	.. 8 × 7 = 2 ,, 8 + 2 ,, 7 = 16 + 14 = 30 × 6 =	180	

3 × 2 "*Packs,*" 4½ *tier* .. .. 7 *tiers to case.*

2⅜ inches	. 5 × 5 = 2 rows of 5 + 2 rows of 5 = 15 + 10 = 25 × 7 =	175	
2⅜ ,,	.. 6 × 5 = 3 ,, 6 + 2 ,, 5 = 18 + 10 = 28 × 7 =	193	(*)
2⅜ ,,	.. 6 × 6 = 3 ,, 6 + 2 ,, 6 = 18 + 12 = 30 × 7 =	210	
2¼ ,,	.. 7 × 6 = 3 ,, 7 + 2 ,, 6 = 21 + 12 = 33 × 7 =	228	(*)
2⅛ ,,	.. 7 × 7 = 3 ,, 7 + 2 ,, 7 = 21 + 14 = 35 × 7 =	245	
2 ,,	.. 8 × 7 = 3 ,, 8 + 2 ,, 7 = 24 + 14 = 38 × 7 =	263	
2 ,,	.. 8 × 8 = 3 ,, 8 + 2 ,, 8 = 24 + 16 = 40 × 7 =	280	

Note.—The "packs" marked thus (*) are packs containing tiers with alternating numbers, the same as those shown in the schedule of packs for the Canadian case. The principle of the method applied to these is the same as that which applies to the alternating pack in the Canadian cases, with the exception of course, that more tiers in apples of the same diameter go to the Australian case than can be packed in the Canadian case. Plate VI. will serve to illustrate the principle.

Relative Merits of the Canadian and Australian Case Compared.

Many of our exporters who have seen the Canadian case raise the objection that, owing to the non-rigidity of the tops and bottoms, more bruising would be likely to take place in the handling during transportation than would occur to fruits packed in the Australian case. A little thought will show, however, that such a contingency is more apparent than real, as the rigidity of the outer covering does not save the contained fruit if dropped or thrown down violently; in fact, the rigidity of the cases is, under such circumstances, a drawback. A tightly packed case of fruit put up in a non-rigid box permits no " give " in any part of such package when subjected to jolts, excepting the cells of the fruits, which, taking the packages as

Fig. (a). Fig. (b).

Plate VI.

2 × 1 pack, 2½ tiers, 6–5 rows = 17 and 16 rows to alternate tiers, 5 tiers to case = 83 apples.
(a) 2nd and 4th tiers, 16 apples to tier; (b) 1st, 3rd, and 5th tiers, 17 apples to tier.

a whole, are the only portion of such package of a fragile character. Briefly, this is an exemplification of the old adage concerning the chain and its weakest link, and the weakest link in a packed case of fruit is the cells of the fruit. The ideal to be aimed at, therefore, is to provide a package which will allow any sudden pressure brought to bear upon these cells to be transferred to the outer package itself in order to minimize the strain upon the cells. The Canadian case seems to " fill the bill " better than the Australian case, as the fruits, when under rough handling, would not meet with direct resistance either from each other or from the sides of the case itself, and therefore would receive, on this account, a minimum of bruising. For

example, if a severe blow or pressure be given to the top of the Canadian case, a corresponding amount of "give" takes place in the bottom of the case, and thus the effect of the pressure on the top is greatly minimized. At any rate, our aim should not be to try and make a case to suit our handling, but should be to try and make our handling suit our case. It is the practice in Canada and the United States of America to line the cases with lining paper cut to the following dimensions:—19¾ inches wide by 26 inches long. Two sheets are used to line the case, the first sheet being placed in the case in such a way as to cover slightly more than half of the bottom and all of one side. The second sheet is similarly placed on the other side of the case. When the case is packed, the paper is folded over so

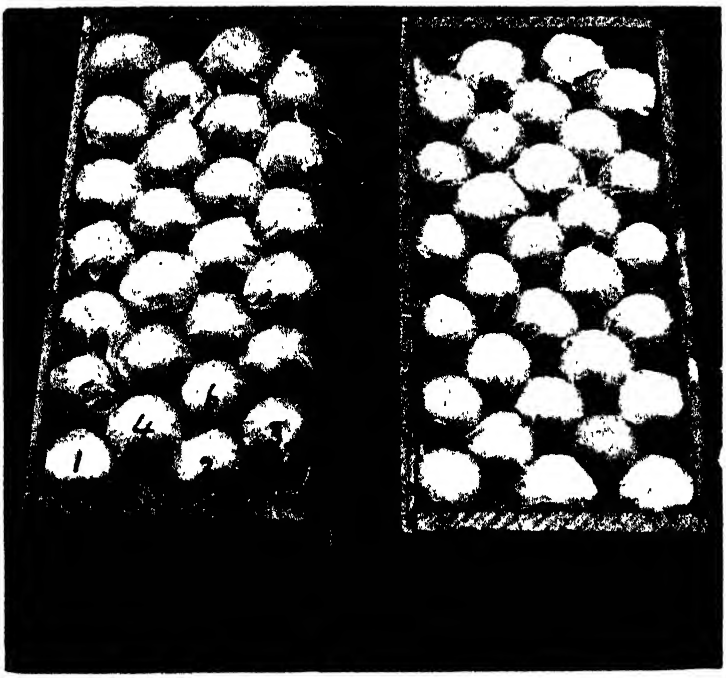


Fig. (*a*). Fig. (*b*).

PLATE VII.

(*a*) 2 × 2 packs, 3½ tier
7–6 rows, 6 tiers
to case = 156 apples.

(*b*) 3 × 2 pack, 3½ tier
6–6 rows, 7 tiers
to case = 210 apples.

as to completely cover the top of the fruit. In some respects this lining of the case may be considered a disadvantage through preventing free air circulation. It has the advantage, however, of keeping the wrappers of top tier of fruit clean and dry, and adds to the attractiveness of the package when opened.

In many respects, other than those mentioned above, our present case falls short of requirements. The hardwood of which it is composed does not lend itself to cutting to sizes of uniform thickness, and makes it very difficult to standardize the thickness of the tops, bottoms, ends, and sides. It thus renders the matter of obtaining a uniform outside measurement very difficult, and operates against fixing a

standard quantity of cases which should go to the ton for shipping purposes. The case is also far from being an ideal one in the way of attractiveness, and does not lend itself to effective marking from an advertising point of view. This is a matter which our growers should consider, as it would appear that, so far, they have not realized the utility of the "gentle art of advertising" to anything like the extent that the growers in North America have done. Plate VIII. shows a cheap, efficient, and attractive label reproduced from a case of apples exported to this State from the Wenatchee Fruit-growers' Association, Washington, U.S.A. A plea that is often put forward in support of the use of Australian hardwoods in the manufacture of our fruit cases is that such action encourages the development of a

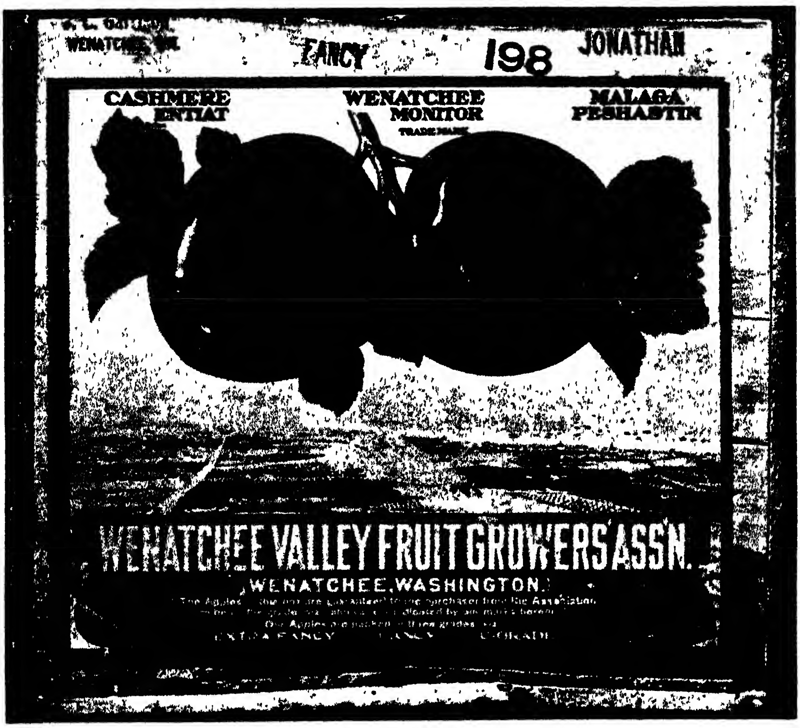


PLATE VIII.

Label on American case of apples

local industry. It should be remembered, however, that the manufacture of fruit cases from our hardwoods is, from an economic point of view, putting this timber to a use for which it is not best suited, as it may, and should, be put to more valuable use, such as in the manufacture of furniture, office fittings, &c. The only serious objection to the Canadian case is that, by reason of the bulge in the tops and bottoms, some waste space is caused in stowage. This drawback, however, is more apparent than real, as when the Canadian cases are used no laths require to be placed between the tiers to permit of the circulation of the cold air in the ship's refrigerator.

(*To be Continued.*)

DAIRY RECORDS.

J. A. Ruddick, Dairy and Cold Storage Commissioner, Ottawa, Canada, writes:—

"Unless the figures are actually before one, the variations in production found in the same herd seem almost incredible. For instance, in three Ontario herds, the difference in yield between the best and the poorest cow runs actually at 8,100, 9,100 and 10,900 lbs. of milk; the extremes in individual cows are 3,690 and 17,615 lbs. This proves that neither an occasional weighing or testing of a sample, nor a hasty reckoning of a herd's average yield can possibly give any measure of justice either to the abundant or to the economical producer, so that the knowledge requisite to building up a good herd has still to be sought. That knowledge can be found in dairy records."—(Circular D. and C. S. No. 7.)

An increase of 600 lbs. of milk per annum or 2 lbs. a day over a milking period of 300 days from each of the cows in this State would yield over another half million pounds sterling to our yearly revenue from dairying.

THE MILLING AND BAKING QUALITIES OF VICTORIAN WHEATS.

(*Continued from page 639.*)

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent; P. R. Scott, Chemist for Agriculture; and F. G. B. Winslow, Departmental Miller.

PART III.

In previous articles consideration was given both to the qualities which made a wheat valuable for milling and baking purposes and also to the methods in vogue for determining these qualities.

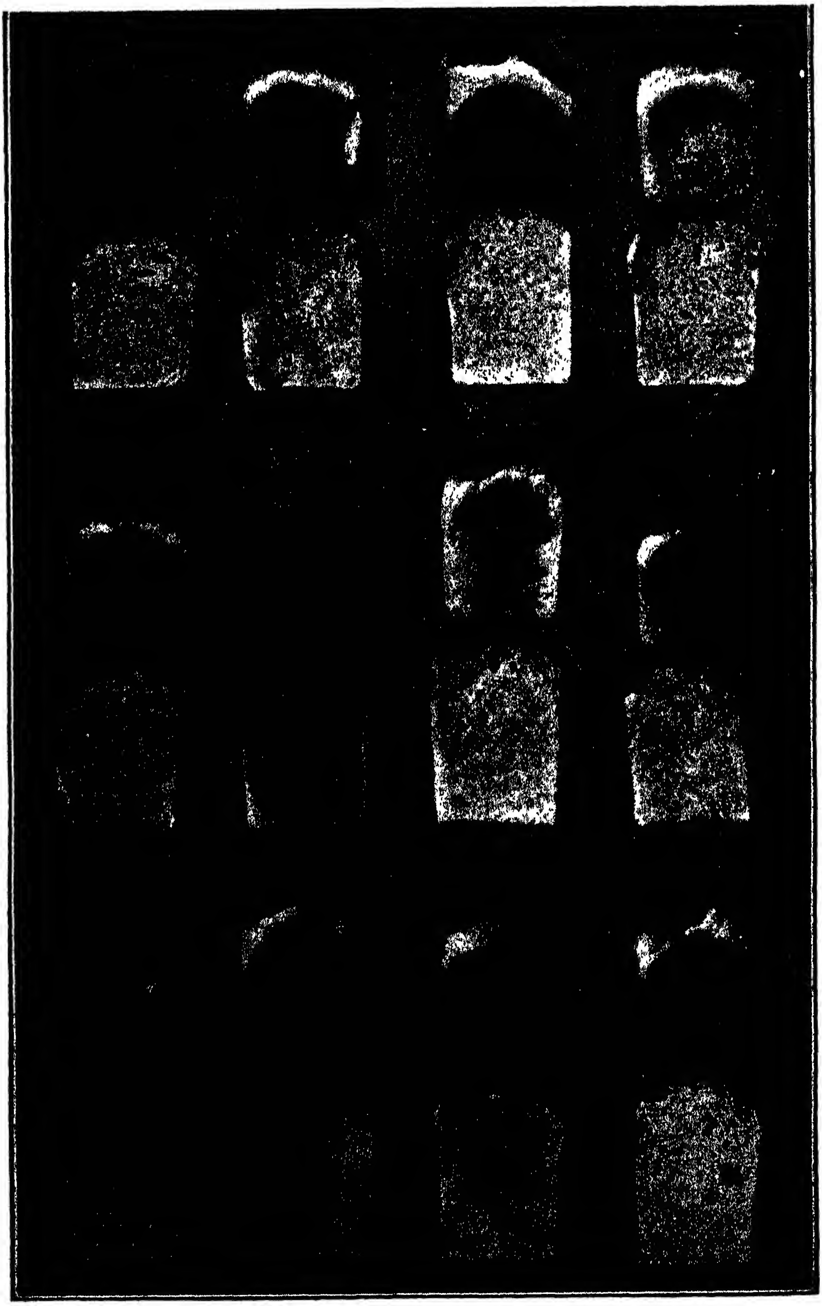
We may now consider the differences in the milling and baking qualities of some typical Australian varieties of wheat. For this purpose the results of milling and baking tests made on a number of varieties of wheat grown at the Rutherglen Experiment Farm and the Longerenong Agricultural College, during the season 1912-13, may be considered. In the process of milling the grain and baking the flour of these varieties practical information regarding the amount of water required for conditioning the grain, the percentage of mill products, percentage of break flour, colour of the flour, weight and volume of a standard loaf, and the general behaviour of the varieties in the mill and in the bakehouse may be obtained. Such information, when expressed in quantitative terms, enables those familiar with the industry to form an idea of the relative values of the different varieties.

During the last season twenty-one varieties of wheat were grown at the Rutherglen Experiment Farm, and eleven varieties at Longerenong. Representative samples of each variety were submitted to a milling and baking test with the object of acquiring the information outlined above. Several of the wheats grown at the Rutherglen

TABLE I.—RESULTS OF MILLING AND BAKING TESTS WITH WHEATS FROM RUTHERGLEN EXPERIMENT FARM.

Name.	Weight per Bushel.	Break Flour.	Water absorbed in conditioning.	Percentage of Mill Products. Flour.	Bran.	Pollard	Colour of Flour.	Weight of Standard Loaf (24 hours after baking).	Texture. Max., 20 points.	Colour. Max., 20 points	Volume of Standard Loaf.	Water absorbed in doughing.	Remarks.
	lbs.	%	%	%	%	%		Grams			c.cm.	.cm	
American 8 ..	66·0	8 8	3·5	70·8	17·1	12 1	Fair	473	14	16	1,310	192	Bran: thick, broad, easy to mill. Grain: small, hard, red, shotty. Dough rose well in oven; loaf: good colour crust.
Bayah ..	65·1	10·0	3·5	72·0	15 8	12·2	Good	465	12	12	1,375	188	Bran: broad, easy to mill. Grain: large, plump. Dough rose well in oven; loaf: dull colour crust.
Bunyip ..	63·0	9·5	3·5	71·9	16 0	12 1	,,	480	20	20	1,430	200	Bran: thick, broad. Grain: large, poor appearance. Dough rose well in oven; loaf: good appearance and colour crust.
Cedar ..	66·0	6 5	7·0	71·8	17·5	10 7	Fair	470	16	12	1,430	244	Bran: small. Flour: granular. Grain: small, hard, shotty. Dough very little rise in oven.
Comeback ..	65·0	10·0	4·0	73·0	14·5	12·5	,,	465	18	12	1,410	220	Bran: small, easy to mill. Grain: small, shotty. Dough hard to knead, slow proving; crust fair.
Dart's Imperial	66·5	12·4	3·0	72·8	16 9	10·3	Very good	465	14	14	1,440	185	Bran: thin. Flour: nice bloom, easy to mill. Grain: good appearance. Dough rose well in oven; good colour crust.
Federation ..	63·0	9·5	3·5	71 1	16·8	12·1	Fair	465	12	16	1,440	185	Bran: thick, easy to mill. Grain: large. Dough: very little rise in oven; medium colour crust.
Firbank ..	64·5	11·2	3·5	72·2	17·0	10·8	Very fair	467	16	14	1,540	187	Bran: broad, thick. Flour: nice bloom. Dough rose well in oven; excellent crust and loaf.
Genoa ..	64·0	8 7	3 5	75·7	14·9	9·4	Very good	467	16	14	1,620	191	Bran: broad, thick. Grain: large, sprouted. Dough rose well in oven; good colour crust.
Gluyas ..	64·0	8 5	3·5	71·6	17·0	11·4	,,	466	20	12	1,375	188	Bran: broad, thick, easy to mill. Grain: dull, plump. Dough: very little rise in oven.
Huguenot ..	66·0	1·4	9·0	71·2	17 2	11 6	Dark	479	12	8	1,310	212	Bran: thin. Flour: ricey. Grain: long, angular, translucent. Dough: hard to knead, slow working.
King's Early	64·8	11 5	3·5	68·7	17·9	13·4	Very fair	466	16	16	1,500	178	Bran: thick. Grain: large, poor appearance. Dough rose well in oven; excellent crust.

Kubanka ..	65·5	3·0	9 0	72 7	15·4	11 9	Dark	478	18	16	1,480	212	Bran: thin. Flour: granular, ricey. Grain: hard and translucent. Dough rose well in oven; crust very yellow.
Medeah ..	65·0	5·1	7·5	73 3	15·5	11 2	,,	474	12	8	1,210	192	Bran: small. thin, difficult to mill. Grain: large, long, translucent. Dough very hard to knead; slow working into dough.
Marshall's ..	63·0	10 0	4 0	72·2	14·9	12·9	Very good	473	12	16	1,400	176	Bran: broad, thin. Flour: excellent bloom. Grain: large, plump. Dough rose well in oven; excellent colour crust.
Thew ..	64·5	9·5	4 5	72 8	16·7	10·5	Dark	467	20	20	1,710	199	Bran: thin, clean. Flour: ricey, granular. Grain: small, hard, semi-translucent. Dough rose very high in oven; excellent colour crust and loaf.
Triumph ..	64·5	11 0	3 5	70 9	15·2	14 9	Poor	471	16	20	1,380	180	Bran: broad, thick, easy to mill. Grain sprouted. Dough: medium rise; excellent colour crust and general appearance.
Turkey Red	64·5	12·0	7·5	71 5	17·1	11·4	Very fair	470	20	20	1,525	192	Bran: thin. Flour: granular. Grain: small and shotty. Dough rose high in oven; easy to work; crust and loaf good appearance.
White Tuscan	65·0	12·2	3·5	72·7	15 4	11·9	Very good	461	16	14	1,400	189	Bran: broad, thin, easy to mill. Grain: large. Dough rose well; loaf and crust good appearance.
Yandilla King	63·1	7·8	3·0	73·5	14·5	12·0	Good	465	8	8	1,170	190	Bran: thick, easy to mill. Grain: large, plump, sprouted. Dough easy to work; rose well, but fell back in oven.
Zealand Blue	65·0	7·6	3·5	72·0	15·5	12·5	Very good	467	20	20	1,440	189	Bran: broad. Flour: good bloom, easy to mill. Grain: medium size, plump. Dough rose well in oven; crust excellent colour.
Victorian Standard f.a.q. sample, 1912–13	63·0	8·2	3·0	70 9	18·9	10·2	Good	466	16	16	1,545	187	Bran: broad. Flour: nice bloom, appearance lively. Grain mixed.

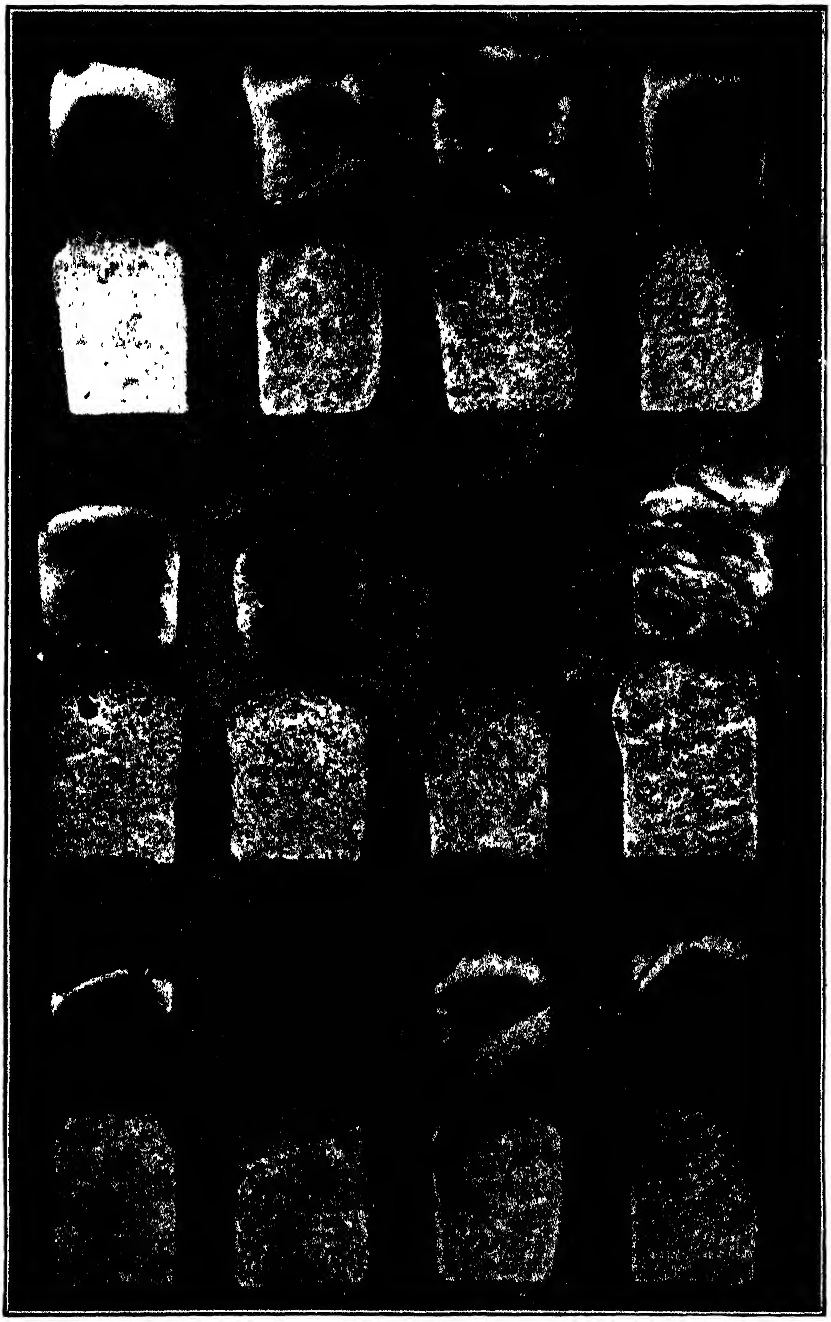


Loaves baked from Rutherglen Wheats.

No. 1. American 8.
„ 2. Bayah.
„ 3. Bunyip.
4. Comeback.

No. 5. Federation.
„ 6. Firbank.
„ 7. Genoa.
„ 8. Gluyas.

No. 9. Huguenot.
„ 10. King's Early.
„ 11. Kubanka.
„ 12. Thew.



Loaves baked from Longerenong Wheats.

No. 13. Turkey Red (Rutherglen).	No. 3A. Federation.	No. 7A. Kubanka.
,, 14 White Tuscan (Rutherglen)	,, 4A. Gluyas	,, 8A Marshall's No 3.
,, 1A Bayah.	,, 5A. Huguenot.	,, 9A. Zealand Blue
,, 2A. Dart's Imperial.	,, 6A. King's Early.	,, 10A. Victoria F.A Q.

Experiment Farm were found to be slightly sprouted as a result of the heavy rainfall during the latter part of November, 1912. Table I. summarizes the results of the milling and baking tests obtained with the Rutherglen wheats.

The percentage of straight grade flour produced from the samples, and this in a large measure determines the value of the grain, varied from 68.7 per cent. in the case of King's Early to 73.5 per cent. with Yandilla King. The break flour varied from 1.4 per cent. with Huguenot to over 12 per cent. with White Tuscan and Dart's Imperial. Break flour, as a rule, has a determining effect in the colour of the flour, the more break flour the poorer the colour.

Similar variations were noted with respect to the amount of water required to bring the grain into condition for milling. The maximum —9 per cent. was required for the flinty durum varieties—Kubanka and Huguenot—while the minimum, 3 per cent., was required by soft varieties like Dart's Imperial and Yandilla King.

As a considerable percentage of the moisture absorbed in the process of conditioning is ultimately retained in the mill products, the amount absorbed by the respective varieties is of some importance to the miller. Generally speaking, the moisture content of Australian wheat is low, more especially in the harvest months and in districts where Summer temperatures are high and the atmosphere extremely dry. During storage in a grain shed or in the process of transportation to Europe, a considerable amount of water is absorbed, and the amount so gained is a direct gain to the wheat exporter. The amount gained during storage or transportation to England largely depends, of course, on the locality in which the wheat is grown. From evidence submitted to the South Australian Royal Commission on the marketing of wheat, it would appear that the increase of weight accruing from storage for a period of six months amounted to from 0.75 to 3.5 per cent. of the total weight of wheat.

With respect to the quantity of bread and the volume of the loaf produced from these varieties, considerable differences were noted. In these tests each flour was treated and baked under similar conditions. (The mode of proving the dough, the temperature of the oven, and the time of baking were kept constant for each variety.) It is questionable whether the best results are obtained from high strength flours by baking them under the same conditions as low strength flours, which form the bulk of the types grown. The method followed does, however, do full justice to the low strength varieties. It will be noted that the yield of bread varied from 461 to 480 grams per standard loaf, and the volume from 1310 c.cm. to 1710 c.cm. What is more important still, the texture and quality of the loaves varied very considerably in the different varieties. An attempt has been made to convey the differences between the loaves of representative varieties by means of photographs.

Besides the orthodox milling tests, it is desirable to obtain information regarding the protein and gluten content of the different varieties, for the nutritive value of the flour depends largely on the ratio of the protein to the carbohydrates.

Table II. supplies information regarding the protein content of the grain and flour, the dry gluten, and the strength of each variety.

TABLE II.—PROTEIN AND GLUTEN CONTENT AND STRENGTH OF VARIETIES GROWN AT RUTHERGLEN, 1912–13.

Name of Variety.	Protein Content of Wheat	Protein Content of Flour.	Gluten Content of Flour.		Ratio of Wet and Dry Gluten.	Strength of Flour.
			Wet.	Dry		
	%	%	%	%		(Quarts per 200-lb. sack.)
American 8	12 50	11 56	29 9	9 60	3·02	45·2
Bayah	12 44	11·37	28·4	9 19	2 90	44·2
Bunyip	13 55	11·99	28 0	9 53	3 11	47 2
Cedar	13 18	11 62	24 63	8 67	3·13	57 2
Comeback	13 06	11 44	25 27	8·90	3 10	51·6
Dart's	10·62	10 12	27 40	8 73	2·84	43·6
Federation	11 62	10·06	28 2	9 12	3 09	44·6
Firbank	11 12	10·31	24 22	8 32	2·91	44·0
Genoa	12 06	11·37	32 60	10·39	3 03	43·0
Gluyas	11 37	10·99	25·60	8·08	3·19	43 0
Huguenot	12 24	11 44	32 37	11 20	2 90	50 0
King's Early	14 00	12 06	23 40	9 83	3·13	42·0
Kubanka	10·99	9·43	27·45	9 25	2 93	50·0
Marshall's	10·31	9·68	25·87	8 11	3·20	42 4
Thew	14·68	13 31	33 8	10 44	2·86	46·4
Triumph	11 12	10·31	26 4	8 25	2 91	42·4
Turkey Red	12 24	11·31	29 44	9 73	3·39	45·2
White Tuscan	11 87	10 37	26·75	8·52	2·84	44·4
Yandilla King	10·99	9 49	27 62	8 91	3 09	44·4
Zealand Blue	10 93	9 87	22 90	7 79	3·16	44·6
The Standard Victorian f.a.q. Sample Season 1912-13	11 68	11·06	25 97	7·81	3·31	44·8

The protein content was determined by estimating the nitrogen content of the wheat and flour by the well-known Kjeldahl process and multiplying the result by 6.25. This factor is used on the assumption that the average nitrogen content of the proteins of the wheat kernel is 16.25 per cent. The amount of wet and dry gluten, and the strength, were estimated as described in previous articles.

It will be noted that the protein content of the wheat varies from 10.31 per cent. with Marshall's No. 3 to 14.68 per cent. with Thew. The standard F.A.Q. sample for the same harvest contains 11.68 per cent. of protein. A similar range is noted in the case of the protein content of the flour, the extremes in this case being 9.43 per cent. with Kubanka and 13.31 per cent. with Thew. The most important of the proteins in the flour are gliadin and glutenin, which together make up the gluten of the flour.*

The figures for dry gluten range from 7.79 per cent. to 10.44 per cent. The gluten content of the standard sample was 7.81 per cent.

The variations in strength or water absorption capacity of the flour range from 42.0 in the case of King's Early to 57.2 per cent. in the case of Cedar.

* *Vide* page 527, *Journal of Agriculture*, September, 1913.

TABLE III.—RESULTS OF MILLING AND BAKING TESTS WITH WHEATS FROM LONGERENONG AGRICULTURAL COLLEGE.

Name.	Weight per Bushel.	Break Flour	Water absorbed in conditioning.	Percentage of Mill Products.			Colour of Flour.	Weight of Standard Loaf (24 hours after baking).	Texture. Max., 20 points	Colour. Max., 20 points.	Volume of Standard Loaf.	Water absorbed in doughing.	Remarks.
				Flour.	Bran	Pollard.							
	lbs.	%	%	%	%	%		Grams			c.cm.		
American 8 ..	65·25	9·8	6·5	67·2	20·3	12 5	Good	465	20	20	1,330	187	Bran: choppy. Flour: granular, good bloom. Grain: small, plump, red. Dough rose well in oven; excellent colour crust.
Bayah ..	64·0	10·7	3·0	70·5	17·0	12·5	Very fair	457	12	12	1,370	183	Bran: thin. Flour: good bloom. Grain: large, plump, soft. Dough rose well in oven.
Dart's ..	64·0	8·0	3·0	70·3	18·0	11·7	Very good	462	12	12	1,450	189	Bran: thin. Flour: good bloom. Grain: small, plump, soft. Dough rose well in oven; good colour crust.
Federation ..	64·5	10·2	3·0	71·6	16 4	12 0	Good	471	12	14	1,490	201	Bran: broad. Grain: medium size, fairly soft, good colour. Dough rose well in oven; colour of crust dull.
Gluyas ..	63·0	12·5	3·0	72·4	15·2	12 4	Very good	460	20	20	1,330	183	Bran: thin, clean. Grain: large, plump, colour good, soft. Dough rose well in oven; excellent colour crust.
Huguenot ..	62·0	1·5	10·0	71·2	18·2	10 6	Dark	460	12	8	1,720	216	Bran: thin, broad. Flour: yellow, ricey, granular. Grain: large, dark amber colour, flinty. Dough very hard to knead; slow in proving.
King's Early	64·2	11·9	3·0	69·8	19·1	11·1	Very good	461	20	16	1,480	178	Bran: broad, thin. Grain: large, plump, fairly hard, good colour. Dough rose well in oven; crust excellent colour.
Kubanka ..	65·0	2·5	8·0	72·3	16·0	11·7	Dark	465	18	14	1,4 80	184	Bran: broad, thin. Flour: ricey, granular. Grain: bright amber colour, large, long, and flinty. Dough rose well in oven.
Marshall's 3..	63·25	10·3	3·5	70·6	18·0	11 4	Good	468	12	14	1,275	191	Bran: broad. Flour: good bloom, granular. Grain: medium size, plump. Dough rose well in oven; excellent crust, and good loaf.
Turkey Red	64·75	12·4	6·5	72·4	16·2	11 4	Very fair	466	20	20	1,450	187	Bran: choppy. Flour: ricey, granular. Grain: small, plump, red colour, and flinty. Dough rose well in oven; excellent colour crust, and good loaf.
Zealand Blue	64·0	9·4	2·5	73 9	17·2	8·9	Excellent	467	16	16	1,520	197	Bran: broad, thick. Flour: good bloom. Grain: large, plump, good colour, soft. Dough rose well in oven; crust excellent colour.

It will be apparent from a study of the above table that the water absorption capacity of the flour does not depend on the amount of protein or dry gluten in the flour.

Turning now to the eleven varieties grown at Longerenong, similar variations in milling and baking quality of the different varieties may be observed.

Table III. gives a condensed summary of the results.

From the above table it will be seen that the amount of break flour produced varies from 1.5 per cent. in the case of Huguenot and similar varieties of the durum class to 12.5 per cent. in the case of soft weak flour varieties like King's Early.

The amount of water required for conditioning varies from 2.5 per cent. in the soft flour varieties to 10 per cent. in the case of the durum wheats.

In percentage of flour produced King's Early stands lowest with 69.8 per cent., whilst the highest yield, 73.9 per cent., was obtained from Zealand Blue.

The protein and gluten contents of the Longerenong varieties are considerably higher than similar varieties produced at Rutherglen. This is clearly brought out in Tables IV. and V.

TABLE IV.—PROTEIN AND GLUTEN CONTENT AND STRENGTH OF VARIETIES GROWN AT LONGERENONG.

Name of Variety	Protein Content of Wheat	Protein Content of Flour	Gluten Content of Flour		Ratio of Wet and Dry Gluten	Strength of Flour.
			Wet.	Dry.		
	%	%	%	%		(Quarts per 200-lb. sack)
American 8	12 56	12 30	33 10	10 67	3 10	44 0
Bayah	12·18	11·62	30 90	10 50	2 94	43·2
Dart's	12 94	10 93	34·43	10·38	3 31	44·6
Federation (Ordinary) ..	11 62	10 43	23·70	8 27	2 86	45 3
Gluyas	11 44	10·87	28 27	9 42	3 00	43·0
Huguenot	14·80	14·00	41·94	14 25	2 94	46·2
King's Early	13 81	12 62	34 70	11 09	3 12	42·0
Kubanka	12 50	11·18	32 25	11 53	2·74	43 4
Marshall's 3 . ..	11·56	9 81	26 38	8·90	2·96	44·2
Turkey Red	12 87	12 30	34·1	10 95	3 11	44·0
Zealand Blue	14·25	12·87	31·0	10 37	3 31	46·4

TABLE V.—AVERAGE PROTEIN AND GLUTEN CONTENT OF LONGERENONG WHEATS COMPARED WITH THE SAME VARIETIES FROM RUTHERGLEN.

—	Protein Content of Wheat.	Protein Content of Flour.	Dry Gluten	Strength of Flour
	%	%	%	(Quarts per sack.)
1. Average content of 11 varieties from Longerenong, 1912–13	13·78	11·72	10·58	44·2
2. Average content of the same 11 varieties from Rutherglen, 1912–13	11·64	10·72	9·08	44·9
3. Standard f.a.q. Sample, 1912–13 ..	11·68	11·06	7·81	44·8

It will be noted that the average protein content of the Longerenong varieties was considerably higher than that of precisely similar varieties from Rutherglen. This fact is more striking when one considers that the varieties at each centre came from the same stock the season before.

The composition of wheat raised on any given spot depends on three main factors—(1) the nature of the season, (2) the nature of the soil on which the seed is grown, and (3) the variety of wheat grown.

There have always been considerable differences of opinion as to how far the quality of the wheat is determined by its environment—*i.e.*, soil and climatic conditions, and how far it may be regarded as characteristic of the variety.

The problem is one of considerable importance both to the wheat breeder and to the miller. A knowledge of the respective parts played by heredity and by environment in the production of quality in wheat is of importance to the wheat breeder whose ultimate objective is the combination into one breed of the valuable qualities possessed by several different varieties. Such knowledge is of value also to the miller, inasmuch as it will enable him to know in what localities and under what conditions the production of high milling and baking quality in wheat becomes possible.

As a result of much investigation and research, it is now generally admitted that the seasonal conditions during the period of growth have a marked influence on the composition and quality of the grain. Lawes and Gilbert* showed that the variations in composition due to season were greater than the variations due to differences in manuring. Later experience tends to confirm this view and to show that the soil has less influence on the quality of the product than the climate.

It has been fairly definitely shown that the more protracted the growing period, and especially the period between fertilisation and maturity of the seed, the less the percentage of protein and the greater the amount of starch in the product. On the other hand, a rapid ripening period is usually associated with high protein and gluten content of the grain, and a low percentage of starch.

The protein content is also associated with the amount of soil moisture in the last stages of ripening. Widstoe† demonstrated that wheat grown on a soil in which the moisture content rapidly diminished during the ripening process resulted in grain of high protein content. Wheat grown on irrigated land has invariably less protein than wheat grown on arid land in the same locality. So far as the influence of mineral plant foods is concerned, it is fairly certain that the application of phosphates leads to increased amounts of phosphorus and potash in the grain. On the other hand, such applications tend to lower the amount of protein and nitrogen in the grain. Moreover, the percentage of protein in the plant also varies with the supply of

* *Journal of Chemical Society*, London, 1884.
† Widstoe, Utah Experiment Station, Bulletin No. 80 (1902).

soil nitrogen. The more available nitrogen found in a soil, the higher the protein content of the kernel. It may be of interest here to note that throughout the growing season monthly determinations of the moisture and nitrate nitrogen content of the respective soils showed that the Longerenong soil contained uniformly higher percentages of nitrate nitrogen than the Rutherglen soils.

The influence of the seed must not be overlooked; though climate and soil can undoubtedly influence the composition and the quality of the grain, it must be remembered that quality is also an hereditary characteristic. This fact is illustrated by considering the inheritance of flour strength in wheat. It has been assumed that it is impossible to grow "strong wheats" in an unfavorable climate, and this assumption seems to be warranted by the fact that in England the growing of high strength wheats is notoriously difficult.

Biffen has recently shown, however, that while many of the imported high strength varieties diminish in strength when grown under English conditions, the variety, Red Fife, maintains its strength unimpaired. So far as Australia is concerned, it used to be supposed that our climatic conditions were such as to prevent the production of high strength wheats; but the creation by Farrer of such varieties as Bobs and Cedar have demonstrated the falsity of this view. The Home Grown Wheat Committee charged with the improvement of English wheat has ruled out of court the idea that strength in wheat is dependent solely on the climate. If strength in wheat were due solely to environment, the breeding of high strength wheats would have to be given up as a hopeless proposition. The results of the tests outlined in the foregoing tests serve as summaries of the milling and baking qualities of the different varieties grown at Longerenong and Rutherglen. It is not to be expected that definite conclusions would result from a single season's work. The repetition of the tests each season amplified by similar tests with typical varieties from moist Gippsland and the dry Mallee should eventually provide systematic information of considerable value.

LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES COLLECTED IN VICTORIA UNDER THE PROVISIONS OF THE ARTIFICIAL MANURES ACTS.

Label No.	Description of Manure.	Manufacturer or Importer.	Moisture.	Nitrogen.		Phosphoric Acid								Potash.		Price asked for the Manure per ton.		
						Water Soluble		Citrate Soluble.		Insoluble.		Total						
			Found	Found.	Guaranteed.	Found	Guaranteed.	Found	Guaranteed	Found.	Guaranteed.	Found	Guaranteed.	Found.	Guaranteed.			
			%	%	%	%	%	%	%	%	%	%	%	%	%	£	s	d
1162	Sulphate of Ammonia ..	Wischer and Co., Melbourne		20·20	20·00	..	..	.	..	..	..	..	..	..	..	16	0	0
1114	Potash Sulphate ..	Cuming, Smith and Co., Melbourne	.	..	..	..	..	.	..	..	..	..	..	52·23	52·00	14	12	6
1106	Superphosphate, O.S. ..	Australian Explosives and Chemical Co., Melbourne	8·03	.	..	16·50	17·00	1·25	1·00	3·27	2·00	21·02	20·00	..	..	4	7	6
1126	" "	" " "	8·13	..	.	16·45	17·00	1·50	1·00	2·75	2·00	20·70	20·00	..	..	4	7	6
1129	" "	" " "	11·08	..	..	16·45	17·00	0·87	1·00	1·18	2·00	18·50	20·00	..	..	4	7	6
1086	Superphosphate, Sickle ..	Cuming, Smith and Co., Melbourne	7·78	..	..	17·60	17·00	1·01	1·00	2·04	2·00	20·65	20·00	..	..	4	7	6
1101	" "	" " "	9·64	..	..	18·47	17·00	0·79	1·00	2·00	2·00	21·26	20·00	..	..	4	7	6
1113	" "	" " "	8·92	.	..	17·65	17·00	0·51	1·00	1·72	2·00	19·88	20·00	..	.	4	7	6
1127	" "	" " "	9·30	.	..	18·01	17·00	1·17	1·00	1·86	2·00	21·04	20·00	..	.	4	7	6
1136	" "	" " "	10·28	..	..	17·69	17·00	0·96	1·00	2·31	2·00	20·96	20·00	..	.	4	7	6
1087	Superphosphate, No. 1 ..	Mt. Lyell M. and R. Co., Melbourne	9·16	..	..	16·87	17·00	1·22	1·00	2·38	2·00	20·47	20·00	..	..	4	7	6
1108	" "	" " "	8·97	..	..	18·78	17·00	0·28	1·00	0·39	2·00	19·45	20·00	..	..	4	7	6
1131	" "	" " "	11·10	.	..	18·62	17·00	0·37	1·00	0·37	2·00	19·36	20·00	..	..	4	7	6
1133	" "	" " "	8·00	..	..	18·14	17·00	1·05	1·00	1·85	2·00	21·04	20·00	..	..	4	7	6
1134	. "	" " "	6·70	..	..	19·09	17·00	0·80	1·00	0·69	2·00	20·58	20·00	..	..	4	7	6
1138	, "	" " "	7·91	..	..	20·79	17·00	1·00	1·00	2·08	2·00	23·87	20·00	..	..	4	7	6
1139	" "	" " "	10·15	..	..	16·87	17·00	1·24	1·00	1·25	2·00	19·36	20·00	.	..	4	7	6
1119	Superphosphate, Rohs ..	P. Rohs, Bendigo ..	11·29	..	..	17·98	16·85	0·06	1·70	0·29	0·45	18·33	19·00	..	..	4	12	6
1165	" "	" " ..	11·93	.	..	18·20	16·85	0·33	1·70	.	0·45	18·53	19·00	..	..	4	12	6
1094	Superphosphate, No. 1 ..	Wischer and Co., Melbourne	8·46	.	.	16·57	17·00	0·50	1·00	2·31	2·00	19·38	20·00	..	..	4	7	6
1105	" "	" " "	9·96		..	17·19	17·00	0·90	1·00	1·78	2·00	19·87	20·00	..	..	4	7	6
1115	" "	" " "	8·48		..	17·92	17·00	0·42	1·00	2·10	2·00	20·44	20·00	..	..	4	7	6
1128	" "	" " "	10·29	..	..	17·12	17·00	0·42	1·00	2·62	2·00	20·16	20·00	..	..	4	7	6
1130	" "	" " "	11·10	..	.	17·21	17·00	0·56	1·00	1·46	2·00	19·23	20·00	.	..	4	7	6
1137	, "	" , "	7·76	.	.	17·21	17·00	1·25	1·00	2·58	2·00	21·04	20·00	..	..	4	7	6
1144	" "	. " "	11·74	.	..	16·76	17·00	0·44	1·00	1·41	2·00	18·61	20·00	..	..	4	7	6
1146	" "	, , "	11·88	..	..	17·10	17·00	0·55	1·00	1·05	2·00	18·70	20·00	.	..	4	7	6

1148	Bone and Superphosphate, No. 1	Australian Explosives and Chemical Co., Melbourne	7·70	1·70	1·50	10·15	8·50	1·64	0·50	9·02	9·00	20·81	18·00	..	..	5	12	6
1164	Bone and Superphosphate, No. 3	„ „ „	11·86	0·89	0·75	13·93	12 75	1·56	0·75	4·64	5·50	20·13	19·00	..	..	5	5	0
1120	Bone and Superphosphate	S. and F. Bugg, Kyneton	8·04	2·16	1·45	7·47	8·05	7·43	7·20	6·40	5·05	21·30	20·30	..	..	5	15	0
1088	Bone and Superphosphate, A	Cuming Smith and Co, Melbourne	9·14	1·63	1·50	12·18	8·50	1·83	0·50	4·55	9·00	18·56	18·00	..	..	5	12	6
1093	„ „ „	„ „ „	9·18	1·44	1·50	12·55	8·50	1·52	0·50	4·43	9·00	18·50	18·00	..	..	5	12	6
1103	„ „ „	„ „ „	11·35	1·88	1·50	12·73	8·50	1·93	0·50	4·15	9·00	18·81	18·00	..	..	5	12	6
1132	„ „ „	„ „ „	11·40	1·81	1·50	12·30	8·50	1·94	0·50	4·24	9·00	18·48	18 00	..	..	5	12	6
1150	Bone and Superphosphate, No 1	J. R. Elsworth, Ballarat	12·12	1·87	1·00	7·83	8·00	1·71	3·00	7·95	7·00	17·49	18·00	..	..	5	7	6
1107	Bone and Superphosphate	A. H. Hasell, Melbourne	8·50	1·13	0·80	10·03	12·75	2·25	1·25	5·78	5·50	18·06	19·50	..	..	5	4	0
1089	Bone and Superphosphate, No. 1	Mt. Lyell M. and R. Co., Melbourne	7·40	1·50	1·50	8·35	8·50	2·60	0·50	8·70	9·00	19·65	18·00	..	..	5	12	6
1092	Bone and Superphosphate, No. 2	„ „ „	6·68	0·86	0·75	14·50	12·75	1·30	0·75	4·20	5·50	20·00	19·00	..	..	5	5	0
1135	Bone and Superphosphate, No. 1	„ „ „	7·12	1·35	1·50	9·00	8·50	1·91	0·50	7·35	9·00	18·26	18·00	..	..	5	12	6
1147	„ „ „	„ „ „	8·67	2·54	1·50	9·37	8·50	0·87	0·50	9·01	9·00	19·25	18·00	..	..	5	12	6
1110	Bone and Superphosphate	P. Rohs, Bendigo ..	10·01	1·83	1·50	8·33	8·00	3·31	4·00	4·46	5·50	16·10	17·50	..	..	5	5	0
1091	Bone and Superphosphate, No. 1	Wischer and Co., Melbourne	6·04	1·60	1·50	8·60	8·50	3·34	0·50	7·62	9·00	19·56	18·00	..	..	5	12	6
1095	„ „ „	„ „ „	5·46	1·48	1·50	8·75	8·50	2·52	0·50	7·90	9·00	19·17	18·00	..	..	5	12	6
1143	„ „ „	„ „ „	10·67	1·45	1·50	10·03	8·50	1·53	0·50	5·12	9·00	16·68	18·00	..	..	5	12	6
1140	Dissolved Bones and Superphosphate	Cuming, Smith and Co., Melbourne	8·06	0·65	1·00	19·70	10·01	0·45	3·88	1·55	5·48	21·80	19·37	..	..	5	10	0
1158	„ „	„ „ „	9·21	0·95	1·00	14·67	10·01	1·34	3·88	4·36	5·48	20·37	19·37	..	..	5	10	0
1152	Nitro Superphosphate ..	Mt. Lyell M. and R. Co. Melbourne	11·51	1·94	1·60	14·45	13·00	0·88	1·00	1·72	2·00	17·05	16·00	..	..	5	10	0
1161	„ „ ..	„ „ „	10·43	1·62	1·60	15·39	13·00	0·65	1·00	1·20	2·00	17·24	16·00	..	..	5	10	0
1100	Ohlendorff's dissolved Peruvian Guano	Gibbs, Bright, and Co., Melbourne	9·80	5·01	..	8·94	..	1·20	..	0·48	..	10·62	..	1·25	..	13	5	0
1121	A.N.A. Surprise Animal Fertilizer and Superphosphate	G. W. Pennell Braybrook	9·60	1·71	1·50	4·63	7·59	4·80	2·95	6·53	5·51	15·96	16·05	..	..	5	10	0
1122	A.N.A. Surprise Fertilizer	„ „ „	9·80	2·93	3·00	..	..	4·43	6·00	9·12	9·00	13·55	15·00	..	..	5	10	0
1167	Bone Fertilizer	J. Cockbill, Melbourne	7·94	4·33	3·50	..	..	2·96	3·50	14·04	14·75	17·00	18·25	..	..	5	10	0
1085	.. ..	Cuming, Smith, and Co. Melbourne	5·29	2·95	3·00	..	..	5·45	3·00	10·67	13·00	16·12	16·00	..	..	6	2	6
1102	„ „	„ „ „	5·23	3·31	3·00	..	..	6·31	3·00	12·89	13·00	19·20	16·00	..	..	6	2	6
1153	„ „	„ „ „	6·04	3·20	3·00	..	..	4·68	3·00	14·55	13·00	19·23	16·00	..	..	6	2	6
1157	„ „	„ „ „	7·99	2·92	3·00	..	..	4·21	3·00	14·37	13·00	18·58	16·00	..	..	6	2	6
1169	„ „	„ „ „	8·73	3·40	3·00	..	..	5·43	3·00	11·17	13·00	16·60	16·00	..	..	6	2	6
1090	„ „	J. R. Elsworth, Ballarat	8·44	3·30	3·00	..	..	6·32	6·00	11·52	11·00	17·84	17·00	..	..	5	12	6
1096	„ „	„ „ „	6·24	2·92	3·00	..	..	5·66	6·00	10·50	11·00	16·16	17·00	..	..	5	12	6
1149	„ „	„ „ „	9·85	2·82	3·00	..	..	5·26	6·00	11·48	11·00	16·74	17·00	..	..	5	12	6
1159	„ „	„ „ „	9·89	2·91	3·00	..	..	5·01	6·00	11·44	11·00	16·45	17·00	..	..	5	12	6

LIST SHOWING RESULTS OF ANALYSIS OF SAMPLES OF ARTIFICIAL MANURES COLLECTED IN VICTORIA UNDER THE PROVISIONS OF THE ARTIFICIAL MANURES ACTS—*continued.*

Label No.	Description of Manure.	Manufacturer or Importer	Moisture	Nitrogen.		Phosphoric Acid.								Potash.		Price asked for the Manure per ton.		
						Water Soluble.		Citrate Soluble		Insoluble		Total.						
			Found	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found.	Guaranteed			
			%	%	%	%	%	%	%	%	%	%	%	%	%	£	s.	d.
1202	Bone Fertilizer	J. R. Elsworth Ballarat	8·06	2·77	3·00	..	..	5·66	6·00	11·87	11·00	17·53	17·00	..	..	5	12	6
1201	Magic Fertilizer, No. 1 ..	G. Gardiner and Co., Geelong	8·44	1·88	2·00	..	..	2·17	6·58	17·52	10·42	19·69	17·00	..	..	5	2	6
1168	Bone Fertilizer	Wischer and Co., Melbourne	8·70	2·84	3·00	..	..	7·66	3·00	12·08	13·00	19·74	16·00	..	..	6	2	6
1163	Leguminous Manure ..	Cuming, Smith, and Co. Melbourne	10·48	..	..	14·97	15·30	0·76	1·00	2·37	1·90	18·10	18·20	2·23	2·60	5	5	0
1116	Vine Manure, No. 6 ..	Mt. Lyell M. and R. Co., Melbourne	1·86	1·35	1·12	5·26	6·37	2·69	0·38	5·07	6·75	13·02	13·50	15·00	13·00	7	17	6
1097	Grass Manure	Wischer and Co., Melbourne	8·60	0·79	0·75	11·20	9·80	0·90	0·75	4·35	5·15	16·45	15·70	1·80	2·60	5	5	0
1200	Potato Manure	,, ,, ,,	10·26	1·02	0·94	13·27	12·97	0·57	0·76	1·26	1·52	15·10	15·25	6·54	5·85	6	7	6

LIST SHOWING RESULTS OF ANALYSES OF SAMPLES OF ARTIFICIAL MANURES COLLECTED IN VICTORIA UNDER THE PROVISIONS OF THE ARTIFICIAL MANURES ACTS—*continued.*

Label No.	Description of Manure.	Manufacturer or Importer.	Moisture.	Nitrogen.		Phosphoric Acid.		Mechanical Condition.				Price asked for the Manure per Ton.
								Fine		Coarse.		
			Found.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	
			%	%	%	%	%	%	%	%	%	£ s. d.
1125	Bonedust	J. W. Branch, Geelong ..	8·24	4 36	3 50	16·72	19·10	46·00	32·80	54·00	67·20	5 5 0
1170	"	T. Brown, Hamilton	8·45	3·40	3·15	21·10	22·00	48·00	33·00	52·00	67·00	6 0 0
1141	Bonemeal	Cuming Smith and Co., Melbourne	5·40	4·15	3·00	21·60	21·00	52·00	30·00	48·00	70·00	7 0 0
1117	Bonedust	J. N. Day, Bendigo	7·93	4·23	4·23	21·14	20·87	28·40	37·00	71·60	63·00	5 15 0
1160	"	F. W. Richards, Warrenheip ..	9·40	3·10	2·50	21·63	24·30	59·00	60·00	41·00	40·00	5 0 0
1109	"	P. Rohs, Bendigo .. .	8·46	4·09	4·00	20·18	18·00	34·10	66·00	65·90	34·00	5 15 0
1166	"	" "	8·80	4·20	4·00	18·40	18·00	38·00	66·00	62·00	34·00	5 15 0
1142	"	Spriggs and Porter. Benalla ..	7·74	3·60	3·74	23·35	23·00	43·00	36·00	57·00	64·00	6 10 0

Government Agricultural Laboratory
Melbourne, 21st October, 1913.

P RANKIN SCOTT,
Chemist for Agriculture.

SUPPLEMENTARY LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF DIRECTOR OF AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS.

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.				Price asked for the Manure per ton.	Where Obtainable.
			Water Soluble.	Citrate Soluble.	In-soluble.	Total		
		%	%	%	%	%	£ s. d.	
Blood and Bone Fertilizer	Redbank Freezing Works	5·75	..	7·16	8·08	15·24	6 6 0	J. Cooke and Co., Melbourne

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid	Mechanical Condition.		Price asked for the Manure per ton.	Where Obtainable.
				Fine.	Coarse.		
		%	%	%	%	£ s. d.	
Bonedust	Marvel	3·74	23·00	36·00	64·00	6 10 0	Spriggs and Porter, Benalla

Government Agricultural Laboratory,
Melbourne, 21st October, 1913.

P. RANKIN SCOTT,
Chemist for Agriculture.

THE FLAVOUR OF BUTTER INJURED BY METALS.

The United States Dairy Division has been investigating the effect of the presence a small amount of iron or copper may have on the flavour of butter. They report that very small amounts of these metals in the cream cause certain undesirable flavours to increase in intensity during storage. These flavours are often designated as "metallic," "oily" or "fishy." Experiments were carried out using known quantities varying from 1 to 500 parts to a million parts of cream. The butter was stored and examined at intervals varying from 20 to 187 days. The most noticeable feature was the rapid development of bad flavours in the butter containing the iron. Butter made from cream which had stood in rusty cans developed a peculiar taste easily picked out. The influence of copper was even more marked than that of iron.

The work shows that if cream is kept in rusty cans or comes in contact with iron or copper during the process of buttermaking, it may take up iron or copper from rusty cans, exposed bolt heads or other metal parts of pasteurizers or churns in sufficient quantity to affect the flavour of storage butter.

While there is nothing to show that the nature of the flavour is appreciably changed, it does demonstrate very clearly that the rate of development of the undesirable flavour is greatly accelerated during storage by very small quantities of iron or copper.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

MONTHLY REPORT ENDING 14th NOVEMBER.

The seventh monthly report of the above competition is as follows:—

The weather during the past month has been very unseasonable and varied greatly from last month. For the first week it was very wet and damp, then fine and warm conditions prevailed with increased temperatures. This lasted about ten days; then it became boisterous and stormy, followed by thunderstorms. On sixteen days of the month rain fell, registering from 7 to 30 points.

The output of eggs for the month was 9,110, as compared with 8,838 eggs last report, and the general average is better than the corresponding seven months of last year.

The leading pen, J. H. Gill (Pen 23) has now a grand total of 999 eggs; whilst C. J. Beatty (Pen 11) is second with a total of 921 eggs; the third, J. S. Spotswood (Pen 6), has 916 eggs to its credit.

Food.—The food was similar to last month. The birds are all healthy and looking well, and any birds where broodiness has taken place are marked with a special ring by Mr. Johnson, the Poultry Expert in charge, for guidance to the owner. In the case of Leghorns, he would advise breeders not to have them put in the breeding pen.

Rainfall for the month—229 points.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition. April 15 to Oct. 14.	Oct. 15 to Nov. 14.	Total to date—7 months.	Position in Competition.
23	White Leghorns	J. H. Gill	838	161	999	1
11	,,	C. J. Beatty	760	161	921	2
6	,,	J. S. Spotswood	753	163	916	3
65	,,	E. A. Lawson	760	146	906	4
48	,,	Thirkell and Smith	758	144	902	5
8	,,	E. H. Bridge	746	148	894	6
10	,,	T. A. Pettigrove	728	155	883	7
61	,,	Jno. Campbell	754	116	870	8
35	,,	Moritz Bros.	701	163	864	9
31	,,	W. G. Swift	715	148	863	10
7	,,	H. McKenzie	689	161	850	11
50	,,	A. H. Mould	693	152	845	12
34	,,	J. E. Bradley	690	153	843	13
21	,,	A. Ross	688	144	832	14
49	,,	M. H. Noye	678	143	821	15
20	,,	C. B. Bertlesmeier	649	165	814	16
66	,,	W. Featherstone	658	151	809	17
40	,,	Geo. Edwards	651	154	805	18
32	,,	H. Hanbury	653	149	802	19
5	,,	G. W. Robbins	644	154	798	20
37	,,	C. H. Busst	667	122	789	21
26	,,	B. Rolls	635	145	780	22
2	,,	R. W. Pope	625	155	780	22
41	,,	Percy Walker	621	151	772	24
58	,,	Stranks Bros.	615	154	769	25
24	,,	Redfern Poultry Farm	615	153	768	26
63	,,	A. Sellers	627	139	766	27
67	,,	C. Hepburn	599	162	761	28
43	,,	Morgan and Watson	627	133	760	29
46	Black Orpingtons	T. W. Coto	663	94	757	30
47	White Leghorns	W. McLister	613	131	744	31
13	Black Orpingtons	T. S. Dallimore	602	137	739	32
14	White Leghorns	F. Hannaford	587	145	732	33
38	,,	M. A. Monk	598	133	731	34
33	,,	South Yan Yean Poultry Farm	562	163	725	35
59	,,	Cowan Bros.	593	128	721	36
45	,,	D. Goudie	594	126	720	37
18	,,	B. Rowlinson	568	144	712	38
42	,,	A. Stringer	564	147	711	39
52	,,	W. G. Osborne	560	149	709	40
12	,,	A. H. Padman	541	159	700	41
62	,,	G. A. Gent	544	151	695	42
27	,,	J. Sinclair	550	142	692	43
3	,,	S. Buscumb	567	119	686	44
25	Black Orpingtons	King and Watson	580	101	681	45
56	White Leghorns	Schaefer Bros.	531	147	678	46
22	,,	B. Mitchell	537	139	676	47
44	,,	W. A. Rennie	520	147	667	48
57	,,	Gleadell Bros.	515	152	667	48
53	Black Orpingtons	A. Greenhalgh	529	129	658	50
54	White Leghorns	James McAllan	507	148	655	51
55	,,	P. H. Killeen	534	115	649	52
51	Black Spanish	W. H. Steer	504	136	640	53
36	White Leghorns	A. J. Jones	500	137	637	54
29	,,	S. Brundrett	474	155	629	55
30	Black Orpingtons	James Ogden	458	160	618	56
28	White Leghorns	E. Waldon	481	128	609	57
19	,,	W. H. Dunlop	470	123	593	58
64	Golden Wyandottes	C. L. Sharman	456	137	593	58
17	R.C. Brown Leghorns	S. P. Giles	467	116	583	60
60	Black Spanish	Watson and Rushworth	426	143	569	61
15	White Leghorns	J. Shaw	410	114	524	62
4	,,	Jas. Brigden	391	130	521	63
9	,,	Sylvania Stud Farm	365	140	505	64
		Totals	38,198	9,110	47,308	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Care of Young Trees.

The care of the young tree at this season of the year is one of the most important of orchard operations. A very considerable number of young trees has been planted out during the past planting season, and it is thought advisable to draw attention to this. Whatever care and attention are given to young trees will be amply repaid to the grower in after years, owing to the vigour, sturdiness, and other qualities thus imparted to them. It is a mistake to plant a young orchard, and, after cutting back the trees, to leave them practically to their own devices, other than following the usual methods of soil cultivation.

The trees, after the early summer cultivation and cleaning of the soil, should be mulched with straw, grass, or leafage of some description. This mulching should not be crowded around the stem, its object being mainly to create moist and cool soil conditions, and to encourage a free root establishment. The mulch material should be occasionally stirred, and no weed or grass growth should be allowed to accumulate amongst it. Where mulching material is not available, a very frequent earth mulch should be given, by constantly stirring the soil within a few feet of the young trees. In addition to mulching, it will be beneficial to spray the young trees with water wherever possible, particularly on hot or windy days. At such times, the transpiration of moisture from the foliage is very excessive and continuous, and a water spray is thus very helpful to the young trees.

Further, all unnecessary buds should be rubbed off, particularly on the main trunk: and all growths in the centre should be pinched back, so as to force as much sap as possible into the growths which will ultimately form the framework of the tree. Similar attention should be also given to grafted trees: although they may not need mulching to the extent that young trees do, yet the water syringings and disbudding work will be of great benefit to them.

Cultivation.

All orchard soils should be kept well worked during the summer months. It is very essential that these should have an abundant supply of moisture during the whole of the growing season. The transpiration from fruit and foliage is considerable at any time; but during hot and windy weather the amount of moisture which is required by a tree, and which is ultimately transpired from the tree, is very exceptional.

Excessive transpiration is often the cause of loss of young trees and of new grafts. They are found to part with a large amount of moisture, and are not able to retain or obtain sufficient for their nourishment; they then very soon wither and die. The soil around these should be kept well stirred; they should also be given a good straw

or grass mulching, and an occasional overhead sprinkling will greatly benefit them.

The planting out of citrus trees may be continued, sheltering the tender plants from winds with hessian or breaks of scrub.

The general aims in summer cultivation should be to keep up a good loose earth mulch during the whole season, and to keep down all the weeds and useless orchard growths.

Pruning.

Summer pruning may now be commenced, particularly on apple, pear, and plum trees. The removal or reduction of surplus leader growths, the shortening of unduly long laterals, and the thinning out of crowded shoots, will all tend to strengthen other parts of the tree, and to increase the development of new fruit buds.

Spraying.

Spraying with arsenate of lead for various pests will now be receiving attention. These include the codlin moth, cherry slug, root borer, looper caterpillar, and various leaf-eating insects.

The question of the number of sprays necessary to keep the codlin moth in check is receiving attention in various parts of the world, and the "one spray method" in the control of this insect is being considerably advanced. The "one spray method" has for its basis the indispensable requisite that the inner calyx cup of the very young apple shall be filled with the poison—the young larvæ seeking entrance therein will be killed by endeavouring to eat their way through.

If it could be shown that in Victoria the codlin moth laid her eggs invariably in the calyx, the "one spray method" would be of extreme importance. But it has already been noted that the moth with considerable frequence places the eggs on the side of the fruit, and also on the foliage; consequently, under such conditions, the "one spray method" would appear to show a weak spot.

The annual appearance of the moths is generally coincident with the blossoming period. If the blossoms are early, the moths will be early, and *vice versa*. This has been proved by the fact that for the last three seasons the moths have always been observed when the trees are in flower, showing that the same climatic conditions influence the moths as well as the trees. This year the moths were early, the blossoming being very early too, as a result of the warm, dry weather experienced in September. The first moth was captured on 30th September, and this is a fortnight earlier than any previous record. It will, therefore, be seen that, to be thorough and effective, the first spraying must be given as soon as, or shortly after, the petals fall; subsequent sprayings may be given as the apples expand. Early spraying has shown that not one per cent. of moth-infected apples is the result, while to delay spraying would allow of the entrance of the caterpillar, and heavy loss will follow.

Cherry trees should be watched for visitations of the pear and cherry slug. As soon as this insect appears the trees should be sprayed with hellebore or tobacco water. If there is no fruit on the trees, arsenate of lead should be used as a spray. The slug should not be allowed to defoliate the tree after the fruit has been picked. Loss of leaves at any season is weakening and injurious to the trees.

Vegetable Garden.

All weeds must be hoed out from the beds, and if these are at all abundant, they may be dug in as green manure, or they may be used for mulching the tomato, melon, marrow, or such plants. Tomato plants should be staked, and all lateral growths pinched out; they should now be well manured and well watered. If not manured, a good weekly watering with liquid manure is necessary.

Asparagus beds should be allowed to mature their growths, and all cutting should now cease. A top dressing of manure will be helpful to the crowns.

Potato and onion beds will require constant hoeing, and it may be helpful to break down the tops of the onions, so as to prevent a too vigorous growth of the top, for the formation of flower beds, and thus strengthen and increase the value of the bulbs.

The long runners and weak lateral growths of plants of the melon family should be pinched back, and liberal supplies of water should be given.

French beans, peas, lettuce, cabbage and cauliflower, &c., should now be sown, the beds being made moist and cool for the planting.

Flower Garden.

As frequently emphasized in the "Garden Notes," surface cultivation is very necessary at this time of the year. To secure a constant earth mulch, as friable as possible, should be the aim of every gardener during the hot months of the year. After every watering or rainfall, the surface should receive a good stirring.

The season has been a very favorable one for roses, and flowers have been produced in fine profusion. For the next two months the roses should have a rest from blooming, so that the autumn crop of flowers may be produced as fine as possible. Water may be almost wholly excluded during this period, provided that the beds or plants be earth mulched, or mulched with some light and non-stimulating material, such as grass or straw.

Late spring flowering bulbs should be lifted, and stored in a cool, dry place. It is advisable to allow the bulbs to become dry before storing them away, by leaving them on the surface and shaded for a day.

All annuals, biennials, and herbaceous plants, which are approaching the period of bloom should now be supplied with frequent supplies of water; and a mulching of well rotted manure will help them greatly.

Dahlias should now be planted out, making two or three plantings, extending to the end of the month. The young plants should be firmly planted in the soil; and, in order to prevent overcrowding when the plants are full grown, the plants should be spaced at least 3 feet apart each way.

Chrysanthemums will now require considerable attention; the weak and unnecessary shoots should be removed, and the remaining growths well staked. All side shoots should be removed as the plants mature. The soil must be kept cool and moist, but excessive or even abundant water must be avoided until the plant is well grown.

The sowing of seed for late flowers may now be made, especially of such plants as zinnias, asters, and winter flowering stocks.

REMINDERS FOR JANUARY.

LIVE STOCK.

Horses.—*Stabled.*—Over-stimulating and fattening foods should be restricted. Water should be allowed at frequent intervals. Rub down on coming into stables in an overheated condition. Supply a ration of greenstuff, where possible, to all horses. *Brood mares* should be well fed on succulent food if available; otherwise, oats and bran should be given. *Foals* may with advantage be given oats to the extent of 1 lb. for each month of age daily. Provision should be made for shade shelter for paddocked horses.

Cattle.—Provide supply of succulent fodder, clean water, and shade shelter.

Pigs.—*Sows.*—Supply those farrowing with plenty of short bedding in well ventilated sties. Those with litters old enough may be turned into grass run *All* sties should be given a plentiful supply of clean water.

Sheep.—Disturb sheep as little as possible during the summer, excessive movement means the subsequent clip is lessened in value, and the condition of the sheep decreased. Remember rams work mostly in the cool of the day and crossbred ewes are only now coming in season. The older the feed becomes the greater the necessity for salt. In wormy country salt should be available at all times. If any sign of dark, unhealthy discharge exists among sheep, drench at once, for unhealthy ewes and wormy weaners attract flies. Salt and Stockholm tar—one pint tar to the 2 cwt. bag of coarse salt—is a useful lick in wormy areas.

Poultry.—Separate the sexes; the cockerels should now be fattened and marketed. Grade the young stock according to age and size, otherwise the younger birds will not thrive. Avoid overcrowding. Do not force pullets too much with animal food; build them up with a good variety of food, but avoid maize, and give but little meat. Increase the green feed; thoroughly spray houses and perches with an emulsion of kerosene and soapsuds, or a solution of carbolic acid 1 in 60. Keep water vessels in shady spot, and renew water twice daily. Moisten dust bath.

CULTIVATION.

Farm.—Get all crops harvested and stacked as soon as possible. Horse-hoe maize, potatoes and other summer crops. See to insurance of stacks of grain and hay.

Orchard.—Keep the soil well scarified and weed free. Cultivate after irrigation or rain. Do not allow the surface to become caked. Spray against codlin moth, pear slug, vine caterpillar, and woolly aphis. Summer prune strong growing shoots and laterals.

Vegetable Garden.—Plant out all seedlings when ready, from former sowings. Stir and mulch the surface. Dig each plot as it becomes vacant. Sow seeds of cauliflower, cabbage, peas, French beans, Kohl Rabbi, &c.

Flower Garden.—Keep the soil moist and cool by watering, hoeing, and mulching. Stake tender and lengthy plants. Water and shade young plants. Sow pansy, Iceland poppy, cosmos, aster, &c.

Vineyard.—This is the slackest month in un-irrigated vineyards—all ordinary work should be completed before Christmas. It is only exceptional operations, such as scarifying after rain or sulphuring in case of odium, that must be carried out. In irrigated vineyards the application of water, and the cultivation it necessitates, require attention.

Cellar.—Fill up regularly and keep cellar as cool as possible. Towards end of month commence to make preparations for the coming vintage.

INDEX OF VOLUME XI.

The Index of Vol. XI. will be supplied with the first number of Vol. XII., viz., 10th January, 1913.